A Study of Clinicoradiological scores for predicting the risk of bowel obstruction and strangulation.

Dissertation submitted to
THE TAMILNADU
DR. M.G.R. MEDICAL UNIVERSITY
CHENNAI – 600 032
with fulfillment of the Regulations
for the Award of the Degree of
M.S. GENERAL SURGERY
(BRANCH – I)

DEPARTMENT OF SURGERY
STANLEY MEDICAL COLLEGE
CHENNAI – 600 001
APRIL – 2013

CERTIFICATE

This is to certify that this dissertation in **"Clinicoradiological scores for predicting the risk of bowel obstruction and strangulation."** is a work done by **DR. BASKAR, A.R.** under my guidance during the period 2010-2013. This has been submitted in partial fulfilment of the award of M.S. Degree in General Surgery (Branch – I) by The Tamilnadu Dr. M.G.R. Medical University, Chennai – 32.

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DECLARATION

I **Dr.BASKAR, A.R.** Solemnly declare that the dissertation titled **"Clinicoradiological scores for predicting the risk of bowel obstruction and strangulation,"** is a bonafide work done by me during the period of Between January 2012 to November 2012 at Government Stanley Medical College and Hospital, under the expert guidance of **Prof. G.MUTHUKUMARAN, M.S.,** and **Prof. Dr.T.S.JAYASHREE, D.G.O., M.S.,** unit chiefs of Department of Surgery, Government Stanley Medical College and Hospital, Chennai.01.

This dissertation is submitted to The Tamilnadu Dr. M.G.R. Medical University, in partial fulfilment of the rules and regulations for the M.S. degree examinations in General Surgery to be held in April 2013.

Chennai-1

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ACKNOWLEDGEMENT

I thank the DEAN of Stanley Medical College and Hospital, **Prof. S. GEETHALAKSHMI, M.D., Ph.D.** for permitting me to conduct this study in the Department of General Surgery of the Government Stanley Medical College and Hospital, Chennai.01.

I thank **Prof. P.DARWIN, M.S.,** Head of Department of General Surgery, for helping and guiding me during the study.

My heartful gratitude to my former unit Chiefs **Prof. SIVAPRAGASAM, M.S., and Prof.G.MUTHUKUMARAN, M.S.,** for them esteemed guidance and valuable suggestions.

It is my privileged duty to profusely thank my teacher, guide, mentor and unit Chief **Prof. Dr.T.S.JAYASHREE, D.G.O., M.S.,** under whom I have the great honour to work as a postgraduate student.

I am greatly indebted to my Unit Assistant Professors **Dr. D.DORAI, D. ORTHO.,M.S., and Dr. CHITHRA, D.G.O., M.S.,** who have put in countless hours in guiding me in many aspects of this study and also in honing my surgical skills.

My gratitude to the Professors and Assistant Professors of all other Units and Radiology. Last but not the least I am thankful to my patients without whom study could not have been completed.

Chennai-1

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CONTENTS

Clinicoradiological scores for predicting the risk of bowel obstruction and strangulation.

INTRODUCTION

Acute obstruction of the bowel is a frequent reason for presentation to the emergency department. Causes of obstruction are multiple (tumorous, inflammatory, postoperative, iatrogenous, metabolic, or congenital), but the clinical presentation is usually nonspecific. Many articles in the radiology literature advocate the use of CT in the diagnostic management of this condition [5]. However, the attitude regarding the treatment is not yet clearly established; because of the imprecision of imaging techniques, many surgeons favour early surgical exploration for fear of misdiagnosing a strangulation [5]. A significant percentage of laparotomies could be avoided if a reliable diagnosis of ischemia was possible preoperatively.

Recent reports have shown the usefulness of CT in the diagnosis of strangulation, especially in the context of acute bowel obstruction [1]. Various CT-specific signs of bowel obstruction have been described, including a transition zone, free peritoneal fluid, reduced contrast enhancement and increased bowel wall thickness[5]. Unfortunately,

radiological signs alone are poorly predictive (50-64%) of bowel ischaemia[4].

The decision regarding conservative versus operative management of bowel obstruction is often based more on individual judgement than evidence-based medicine. Many clinicians rely on physical examination and plain abdominal radiography. There is a need for an objective clinical scores to quantify the severity of bowel obstruction and the risk of strangulation. The present study therefore retrospectively asses patients presenting with acute bowel obstruction and underwent laparotomy by measuring various clinical, laboratory and radiological parameters to predicting the risk of bowel obstruction and strangulation.

AIM OF THE STUDY

The purpose of our study is to determine retrospectively validate the scores for predicting bowel obstruction and strangulation, the need for subsequent laparotomy and intestinal resection.

1. To identify risk of strangulation Vs clinical symptoms.
2. To identify risk of strangulation Vs clinical signs.
3. To identify risk of strangulation Vs blood investigations.
4. To identify risk of strangulation Vs radiological signs.
5. To identify Various clinical, laboratory and radiological parameters to predicting the risk of bowel obstruction, Adhesiolysis Vs intestinal resection.
6. To identify Various clinical, laboratory and radiological parameters to predicting the risk of ischemia in bowel obstruction.
7. To compare available scores in literature for bowel obstruction.

REVIEW OF LITERATURE

HISTORICAL HIGHLIGHTS AND PIONEERS IN TREATMENT

1. HIPPOCRATES and CELSUS (500 BC).

Hippocrates the father of medicine, and Celsus the most distinguished medical authors followed the pattern of Egyptian treatment which was the administration of purgatives and enema for consecutive days once in a month to clear the bowels and as a prophylactive measure.

2. AMBROISE PARE (1510-1590AD).

A French physician who identified bowel obstruction for first time and had reported a patient who died of twisted bowel.

3. HEISTER (172AD)

Described a successful resection of strangulated intestine with diversion of faecal stream.

4. PILLARE (1776AD)

He successfully made a caecostomy for a case of carcinoma rectum.

5. PAUL AND BLACK (1846 & 1892AD).

Proved that the exteriorisation of the colon is preparable to a major surgical procedure like primary anastomosis.

6. PAUL AND MICKULICKZ (1908AD).

Advocated the procedure of exteriorisation.

7. KLOIBER (1919AD)

Published a paper emphasizing the usefulness of x-rays in discerning the level of bowel obstruction.

8. HENRI HARTMANN (1921AD)

He described the Hartmann procedure. It is an alternative procedure for recto sigmoid growth; it involves resection of the sigmoid colon with proximal diversion and over sewing of the distal stump.

9. MUIR (1968AD)

On table colonic lavage can be used to prepare the bowel intra operatively for a primary anastomosis. This technique was first described by him.

SURGICAL ANATOMY

The intestine which is the longest part of the digestive tract is divided into the longer less distensible small intestine and shorter more distensible large intestine.

Small intestine:

The small intestine, consisting of the duodenum, jejunum, and ileum, extends from first part of duodenum to the ileocaecal junction. It is about 6 to 7 meters long. The upper fixed part is the duodenum. The lower mobile part of the intestine is the jejunum and ileum which is attached by mesentery.

Duodenum:

Duodenum is 25 cm long. It is divided into four parts:

- Superior (first) part: short (5 cm) and lies anterolateral to the body of the L1 vertebra.
- Descending (second) part: longer (7to10 cm) and descends along the right sides of the L1 to L3 vertebrae.
- Horizontal (third) part: 6to8 cm long and crosses the L3 vertebra.

- Ascending (fourth) part: short (5 cm) and begins at the left of the L3 vertebra and rises superiorly as far as the superior border of the L2 vertebra.

Jejunum and Ileum:

The second part of the small intestine, the jejunum, begins at the duodenojejunal flexure. The third part of the small intestine, the ileum, ends at the ileocecal junction. The Jejunum and Ileum are suspended from the posterior abdominal wall by the mesentery and therefore considerable mobility.

Large Intestine:

The large intestine consists of the cecum, appendix, ascending, transverse, descending, sigmoid colon, the rectum and anal canal. It is about 130 cms – 150 cms long [6].

It is divided into

1. Caecum – 7.5 cms
2. Ascending colon - 12.5 cms
3. Transverse colon - 45 cms
4. Descending colon - 25 cms

5. Sigmoid colon - 40 cms

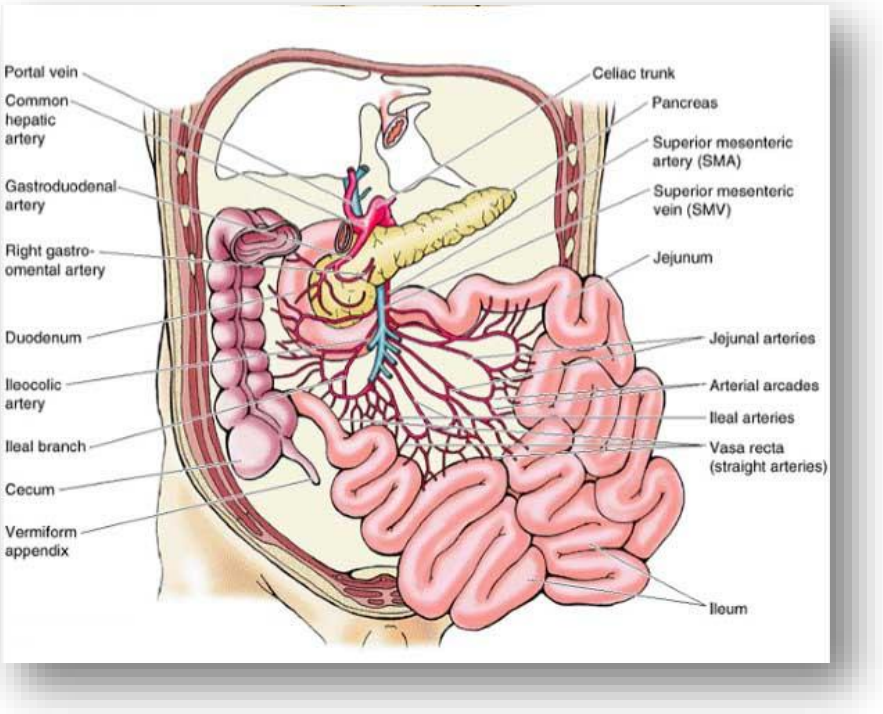
6. Rectum - 15 cms

7. Anal canal - 4 cms

In the angle between caecum and the terminal part of ileum there is a blind intestinal diverticulum called vermiform appendix. The greater part of large intestine is fixed except for the appendix, transverse colon and sigmoid colon.

ARTERIAL SUPPLY:

Duodenum – Up to the level of the major duodenal papilla the duodenum is supplied by the superior pancreatico duodenal artery and below it by the inferior pancreatico duodenal artery. Ileum & Jejunum - Supplied by superior mesenteric artery. The caecum, Ascending colon, right two thirds of the transverse colon are supplied by superior mesenteric artery.

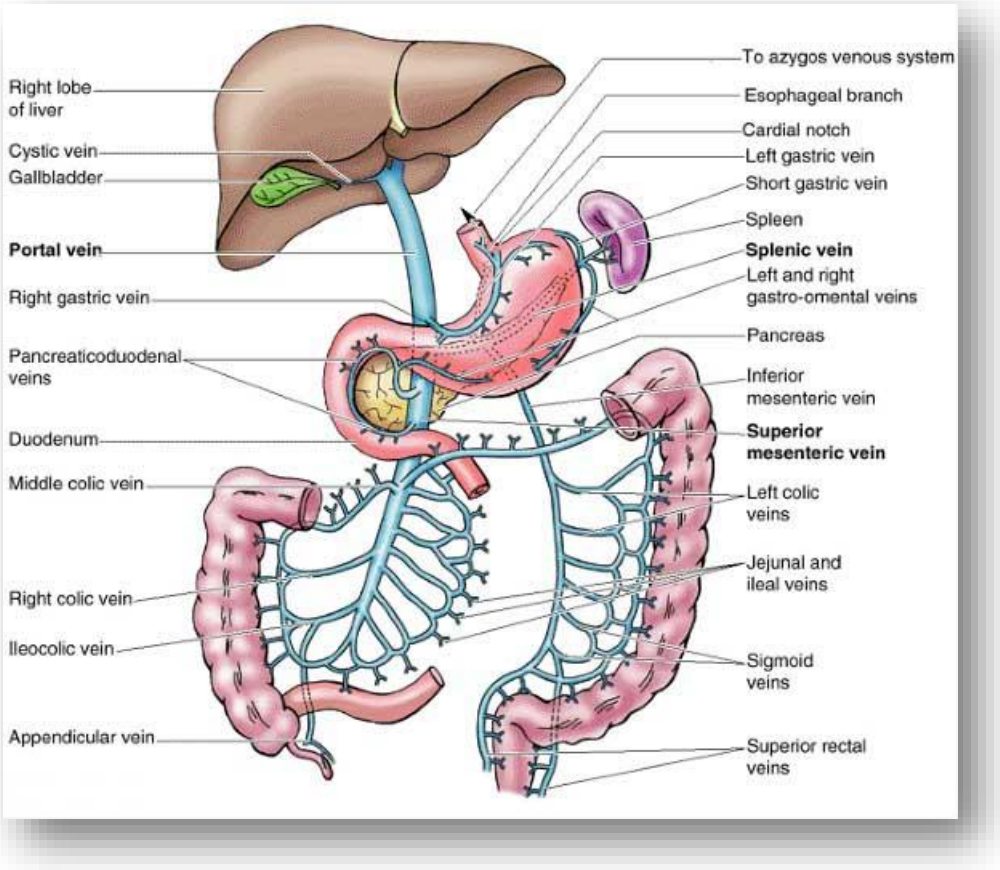


The Left one third of transverse colon, descending colon upto upper one third of rectum are supplied by the inferior mesenteric artery. The middle rectal artery from anterior division of internal iliac artery supplies the lower part of the rectum. The part of the anal canal above the pectinate

line is supplied by the superior rectal artery. The part below the pectinate line is supplied by inferior rectal artery.

VENOUS DRAINAGE

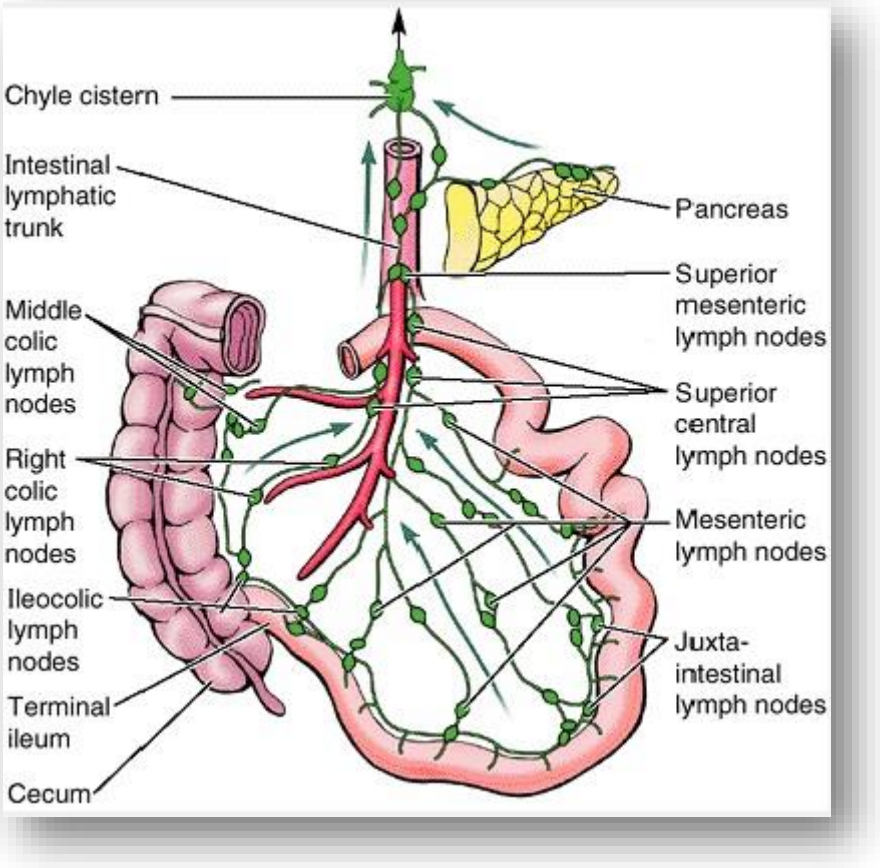
The venous drainage of duodenum is into the splenic, superior mesenteric and portal veins.



The jejunum and ileum are drained by the superior mesenteric vein. The caecum, ascending colon, right two third of transverse colon are drained by the superior mesenteric vein.

The left one third of transverse colon, descending colon, sigmoid colon, and upper one third of rectum are drained by the inferior mesenteric vein. The lower two third of the rectum is drained by the internal Iliac vein. The Anal canal is drained by the superior and inferior rectal vein.

LYMPHATIC DRAINAGE OF SMALL INTESTINE



Most of the Lymph vessels from the duodenum end in the pancreatico duodenal nodes. From here the Lymph passes partly to the hepatic nodes, and then to the coeliac nodes and partly to superior mesenteric nodes. Lymph from Ileum and jejunum drains into numerous

lymph nodes present in the mesentery, and along the superior mesenteric artery.

LYMPHATIC DRAINAGE OF LARGE INTESTINE

The nodes are arranged on a plan common to all parts of the large and small intestine.

They are numerous and arranged in three groups.

(a) Proximal

(b) Intermediate

(c) Distal

Proximal nodes

These nodes are situated on the main blood vessels to the gut, (i.e.) superior mesenteric, Ileocolic, right colic, left colic, middle colic, inferior mesenteric, superior rectal, sigmoid.

The Intermediate Nodes

The intermediate nodes are situated along the larger branches of the above named vessels.

The Distal Nodes

The distal nodes are situated near the gut between the numerous small vessels entering the gut.

ACUTE INTESTINAL OBSTRUCTION

DEFINITION

Impairment to the aboral passage of intestinal contents may result from either a mechanical obstruction or the failure of normal intestinal motility in the absence of an obstructing lesion (Ileus).

TYPES OF PRESENTATION

A. Depending on onset.

i. Acute.

ii. Acute on Chronic.

iii. Sub acute.

iv. Chronic.

B. According to the degree of obstruction.

i. Partial.

ii. Complete.

C. According to the absence or presence of Intestinal ischemia.

i. Simple

ii. Strangulated

D. Depending on Site of obstruction.

i. Small bowel.

ii. Colonic.

E. According to the Level of obstruction.

i. High small bowel obstruction.

ii. Low small bowel obstruction.

iii. Large bowel obstruction.

F. Depending on blockade at both ends of an intestinal loop

i. Open loop obstruction.

ii. Closed loop obstruction.

G. Depending on the cause.

i. Dynamic.

ii. Adynamic.

iii. Peristalsis may be absent-eg: paralytic ileus.

iv. Non Prospulsive form of obstruction – eg: mesenteric vascular occlusion [13].

AETIOLOGY:

Mechanical small bowel obstruction is responsible for most cases that need surgical intervention and conservative management. The causes of bowel obstruction can be conveniently divided into intrinsic, extrinsic and intraluminal lesions.

CAUSES OF SMALL BOWEL OBSTRUCTION

1. Intrinsic Bowel lesions.

    A. Congenital

        i. Atresia.

        ii. Stenosis.

        iii. Malrotation.

        iv. Meckel's diverticulum.

    B. Traumatic.

        i. Hematoma.

        ii. Ischemic stricture.

    C. Inflammatory.

        i. Infections – e.g: Tuberculosis.

        ii. Inflammatory bowel disease(Crohn's disease).

        iii. Radiation Injury.

        iv. Ischemic injury.

v. Drugs and chemicals.

vi. Diverticulitis.

vii. Postanastomotic.

D. Neoplastic.

i. Primary Neoplasms.

ii. Metastatic Neoplasms.

iii. Peutz Jeghers syndrome.

E. Miscellaneous:

i. Intussusception.

2. Extrinsic Bowel Lesions.

A. Congenital bands.

B. Adhesions.

C. Hernias.

D. Volvulus.

E. Abscess.

F.Endometriosis.

G. Carcinomatosis.

3. Intraluminal.

A. Gallstone ileus.

B. Enterolith.

C. Swallowed foreign body.

D. Bezoar.

E. Balloons of intestinal tubes.

F. Parasites e.g: Ascaris.

III. Outside the wall.

A. Bands and adhesions.

B. Internal hernias.

C. External hernias.

D. Volvulus.

E. Tumours in adjacent organs.

F. Enlarged lymph nodes.

Most common causes of small bowel obstruction are hernias, post operative intra abdominal adhesions and neoplasms.

1. HERNIAS:

Inguinal, femoral, ventral hernias and less frequently internal hernias are one of the common causes of acute intestinal obstruction in most of the country.

Mucha reported that strangulated obstruction occurred in one third of the patients due to hernias, whereas only 8% of patients with adhesive obstruction had strangulated bowel.

Brolin and colleagues found that each of the 22 patients of intestinal obstruction due to hernias was complete, whereas only 38% of patients with obstruction due to intra abdominal adhesions were complete [9]. The obliquity of the inguinal canal and the higher frequency of Occurrence of inguinal hernia the most frequent variety associated with small bowel obstruction. The rigid fascial defect through which the herniated intestine protrudes is particularly the common cause of strangulation.

The occurrence of small bowel obstruction in a patient without prior laparotomy should suggest a hernia as the cause. If no hernia is discovered on physical examination, internal hernias such as paraduodenal and obturator hernias must also be considered.

Retro anastomotic and parastomal hernias are also important causes of intestinal obstruction in patients who have had operative procedures in which mesenteric defects may be present.

2. ADHESIONS

The most common etiology of small bowel obstruction is intra abdominal adhesions following laparotomy, accounting for about 66% to 75% of patients [9].

Intra peritoneal adhesions, Adhesiolysis done for this cases

Causes of intra peritoneal adhesions.

a. Ischemic areas.

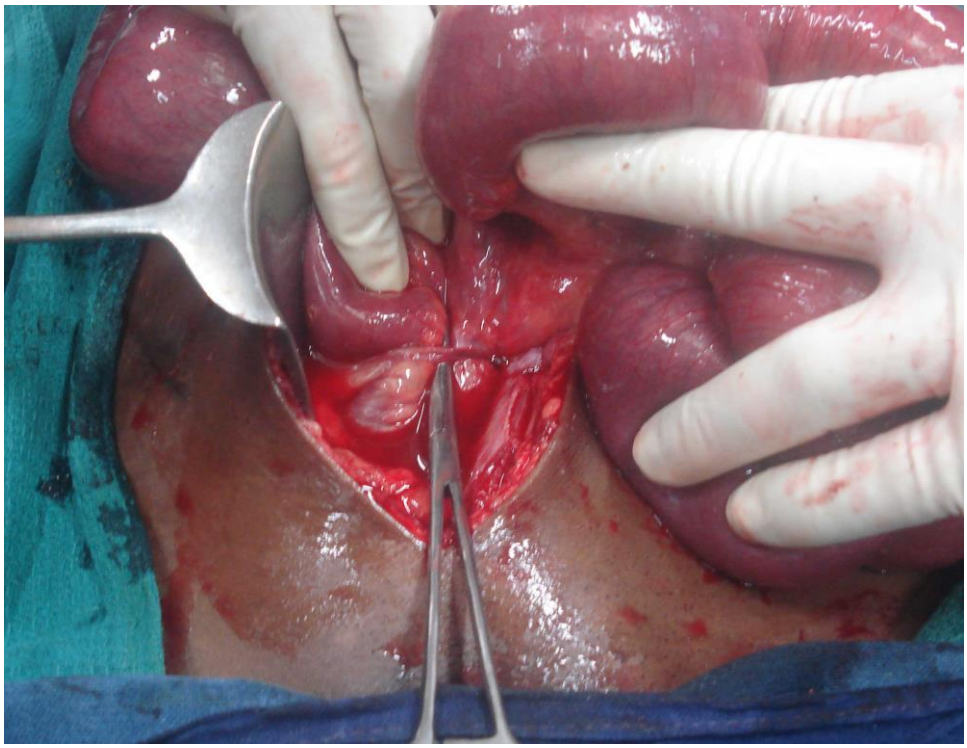
b. Infections.

c. Presence of Foreign bodies.

d. Inflammatory disease.

e. Radiation enteritis.

Lower abdominal, pelvic procedures and previous peritonitis have a higher risk of post operative adhesive obstruction than upper abdominal procedures.



Adhesive band cause for strangulation

3. NEOPLASMS:

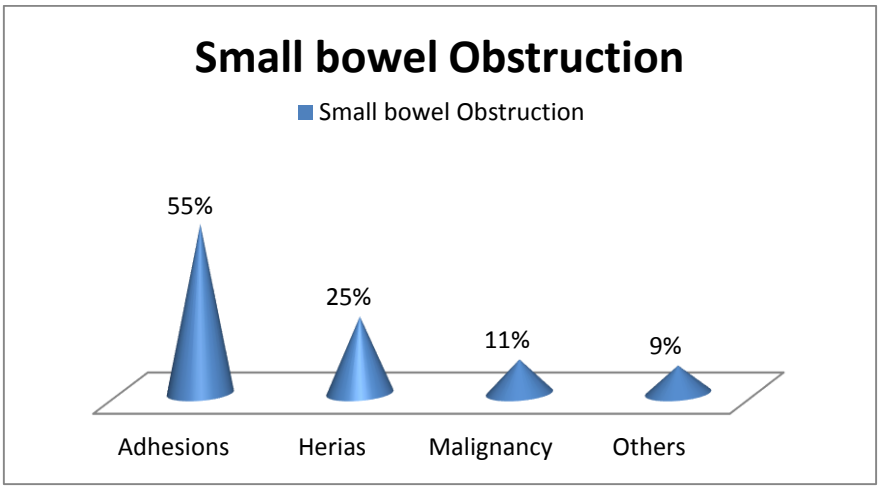
In contrast to colonic obstruction, neoplasms are a relatively unusual cause of small bowel obstruction, accounting for about 11% of cases. Most commonly, the small intestine is obstructed by extrinsic compression or local invasion by advanced gastro intestinal (Pancreatic, colonic, gastric) or

gynaecological (ovarian) malignancies. This mechanism accounted for 92% of neoplastic small bowel obstruction in a Mayo Clinic series [9].

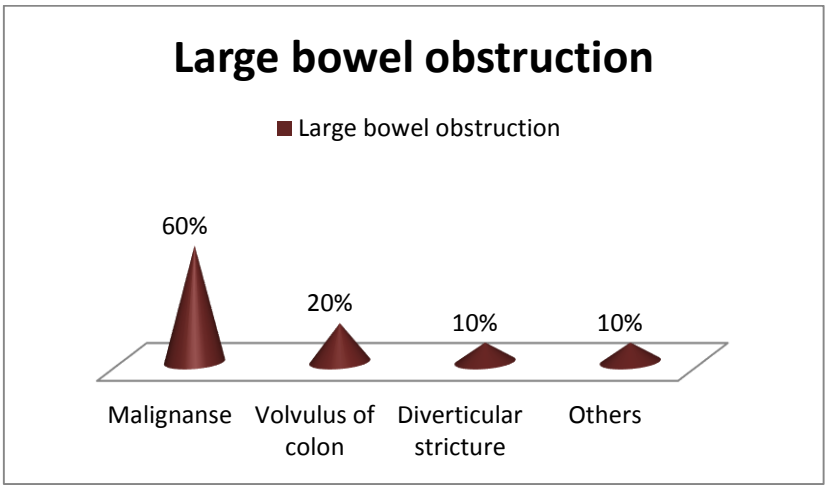
Hematogenous metastases from breast carcinoma and melanoma also involve the intestine with subsequent obstruction.

Primary neoplasms of the small intestine are the cause of obstruction in less than 3% of cases. Carcinoid tumors and adenocarcinoma have been variably reported as the most common malignancy of the small intestine. Adeno carcinoma of small intestine arises more frequently in the duodenum and jejunum than in ileum [9].

a) Small bowel Obstruction



b) Large bowel Obstruction



4. CROHN'S DISEASE

In crohn's disease, bowel obstruction usually occurs under two different conditions.

1. In the acute exacerbation of the crohn's disease, the bowel obstruction is the result, of a reversible inflammatory process within the bowel wall that causes a narrowing of the bowel lumen.

2. Small bowel obstruction may also be the results in chronic stricture.

5. RADIATION ENTERITIS (ENTEROPATHY)

Radiation to the bowel is a result of obliterative vasculitis and fibrosis consequent to radiation therapy. This progressive obliterative endarteritis is a dynamic, relentless process that lead to a chronic recurrent low grade obstruction of the small intestine or cicatrization and bleeding in the colon and the rectum.

6. INTUSSUSCEPTION IN ADULTS

One segment of intestine (intussusceptum) telescopes within an adjacent segment (intussuscipiens), resulting in obstruction and possibly ischemic injury to the intussuscepting segment. In most adult patients (up to 93%) there is an underlying pathologic process, most commonly a tumor (benign 52% and malignant 48%). Congenital lesions (e.g: Meckel's diverticulum or small bowel duplication) or other localized abnormalities of the intestinal tract compose the remainder. Primary Idiopathic Intussusception accounts for only a small number of all instances in adults and caused by Parasympathetic suppression [8]. Motility enhancing drugs such as erythromycin have been effective in treating this condition. There are various reports of the success of neostigmine in achieving decompression.

PATHOPHYSIOLOGY

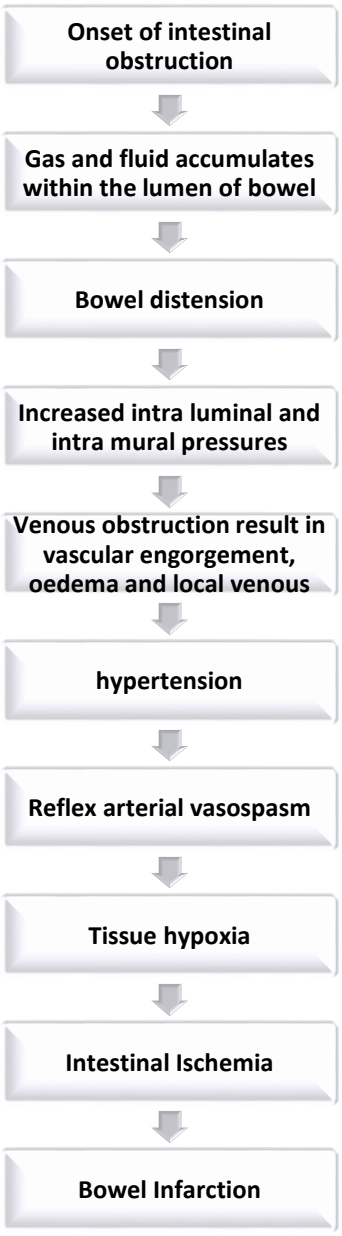
Absorption and Secretion

Intestinal obstruction has marked effects on intestinal absorption and secretion. In mechanical obstruction, intestinal secretions accumulates as the intestine distends, causing a major disruption in the orderly balance of secretion and reabsorption. In early intestinal obstruction (before 12 hrs) water and electrolytes accumulate in the lumen because of a decrease in absorption with little effect on intestinal secretion.

After 24 hrs intraluminal water and electrolytes accumulate more rapidly secondary to a further decrease in absorption with a commensurate increase in intestinal secretion.

If obstruction persists, the proximal intestine dilates, absorption decreases, secretion increases, and net effect is intraluminal fluid accumulation. Intraluminal fluid sequestration initiates an inflammatory cascade by attracting and activating neutrophils. The subsequent release of oxygen, free radicals and oedema promoting peroxidation products, such as leukotriene B4 and interleukin-1 exacerbates the plasma extravasation and transudation, resulting in a net fluid secretion into the obstructed bowel.

PATHOPHYSIOLOGY OF STRANGULATED BOWEL



Blood Flow

When mechanical obstruction persists, intestinal distension increases, and intra luminal pressures increases, the effect on intestinal blood flow then becomes important, especially considering its association

with strangulation obstruction. Intestinal blood flow is related inversely proportional to intraluminal pressures. When the intraluminal pressure is increased to 30 mm Hg, capillary streaming was interrupted; by 60 mm Hg, blood flow was interrupted in vessels [8].

As the obstruction persists other changes ensue. Reduced mucosal blood flow during small bowel obstruction leads to relative ischemia and hypoxia to villous tips. During this period, oxygen derived free radicals and their derivatives appear to play an essential role in the changes that follow the early phase. Inflammatory fluid collected in intraabdomenal cavity also.

Bacteriology

Normally mucosa of the gastrointestinal tract maintains a barrier to prevent resident bacteria that normally exist within the gut lumen from entering the systemic circulation. Under certain conditions, this immunologic gut barrier may break down and increase vascular permeability. So indigenous bacteria colonizing the gastro intestinal tract can cross the mucosal epithelium (translocation) to infect mesenteric lymph nodes and even in systemic circulations.

Therefore with established mechanical small bowel obstruction, pre operative antibiotic prophylaxis is indicated and peritoneal spillage of small intestinal content must be avoided.

Systemic pathophysiologic effects of intestinal obstruction

Systemic response to intestinal obstruction involves an initial isotonic contraction dehydration secondary not only to the intestinal and peritoneal sequestration of extracellular fluid but also to the associated vomiting and decrease intake. Hypokalemia is secondary to the persistent vomiting, intestinal secretion, and an increase in aldosterone concentration that occur in response to the hypovolemia. Cardiovascular effects manifest as tachycardia and relative hypotension due to secondary to hypovolemia.

Respiratory compromise occur with severe abdominal distension or secondary to aspiration of vomitus. Intestinal ischemia may precipitate a metabolic acidosis and sepsis with associated vascular collapse.

Causes of Intestinal distension

1. Gas - Originates from swallowed air and air produced by bacteria within the intestine.

2. Fluids - This consists of swallowed liquids, gastric, biliary, pancreatic and intestinal tract secretions.

OBSTRUCTION

The viability of the bowel is threatened by vascular compromise by

A. External compression (hernial orifices, adhesion, bands)

B. Interruption of the mesenteric flow (Vovulus, intussusception)

C. Primary obstruction of the intestinal circulation (mesenteric ischemia- arterial or venous)

Except in the case of mesenteric infarction, the venous return is affected before the arterial supply. The sudden increase in capillary pressure results in escape of intra vascular fluid and diapedesis of red blood cells into the bowel wall, its lumen and the herinal sac or peritoneal cavity. The bowel wall becomes oedematous and haemorrhagic. The peritoneal exudates become blood stained. As the arterial supply becomes jeopardized haemorrhagic infarction sets in. The mortality depends on the age and the extent of infarction and any delay in start of appropriate treatment.

PARALYTIC OR ADYNAMIC ILEUS

Ileus refers to the failure of aboral passage of intestinal contents in the absence of mechanical obstruction.

Causes:

1. Laparotomy.
2. Electrolyte disturbances.

   Hyponatremia, Hypokalemia, Hypomagnesemia
3. Drugs.

   Narcotics, Anticholinergic agents, Phenothiazines, Diltiazem.
4. Intra abdominal inflammation.

   Perforated duodenal ulcer Appendicitis, Diverticulitis, Peritonitis.
5. Retroperitoneal inflammation or haemorrhage.

   Lumbar vertebra fracture, Acute Pancreatitis, Pyelonephritis.
6. Intestinal ischemia.

   Mesenteric arterial embolus, Mesenteric venous occlusions, atherosclerosis, thrombosis, Chronic mesenteric Ischemia, Hypotention.
7. Thoracic diseases.

   Lower rib fractures, Lower lobe pneumonia, Myocardial infarction.
8. Systemic Sepsis

Post operative ileus is thought to result from the loss of normal coordination of intestinal contraction by the intrinsic electrical activity of the bowel [9].

CLINICAL FEATURES

The hallmark of intestinal obstruction is abdominal pain, vomiting, obstipation and abdominal distension.

The magnitude of symptoms depends on the degree of obstruction (i.e) complete or partial and proximal or distal obstructions and duration of obstruction.

CLINICAL PRESENTATION

A. Abdominal pain.

Pain is episodic, crampy and poorly localised. Simple obstruction provokes paroxysm of sharp pain, alternating with pain free intervals. If colickly pain becomes constant, strangulation or perforation may have developed. Unremitting pain, out of proportion to the physical findings is typical of mesenteric vascular ischemia.

BOWEL OBSTRUCTION: CLINICAL PRESENTATION AND RADIOLOGICAL FINDINGS

	Features	High small bowel obstruction	Low small bowel obstruction	Large bowel obstruction
1.	Onset of symptoms	Sudden	Gradual	Insidious
2.	Site of pain	Epigastric, intense, colicky often relieved by vomiting, occasionally continuous	Periumbilical	Central or lower abdominal, possibly associated with generalised discomfort
3.	Vomiting	High volumes, bilious, frequent	Low volume and frequency; progressively faeculent with time	Intermittent, not frequent, faeculent
4.	Tenderness	Epigastric or periumbilical usually mild unless strangulation is present	Diffuse and progressive	Diffuse
5.	Distension	Mostly Absent	Diffuse and progressive	Diffuse
6.	Obstipation	May or may not be present	Mild or moderate	Complete
7.	Radiologic Findings	Abdomen may appear gasless or show distended proximal small bowel	Gaseous distension of small bowel, fluid levels on erect film	Gaseous distension of large bowel proximal to obstruction, small bowel may also show distension

B. Vomiting.

Vomiting occurs early and bilious in high small bowel obstruction but may be absent or develop late in distal small bowel obstruction or colonic obstruction. At first, the vomitus may contain altered food but later

it becomes bile stained. Finally when the obstruction becomes complete and the dilated obstructed intestine allows bacteria to proliferate in the stagnant intestinal lumen the vomitus turns faeculent and foul smelling indicating late estabilished intestinal obstruction.

C. Obstipation.

Obstipation is a late feature. The failure to pass flatus or faeces, occurs after the bowel distal to the obstructed segment empties. Partial bowel obstruction often permits passage of small bouts of gas and faeces.

D. Abdominal distension.

It is usually delayed with obstruction of the most proximal small bowel. Gross distension is obvious in sigmoid volvulus, Hirschprung's disease and low small bowel obstructions and cecal neoplasms.

PHYSICAL EXAMINATION

- Patients usually appear ill.
- Signs of dehydration – sunken eyes, dry mucous membranes, loss of skin turgor, tachycardia and hypotension
- Fever – suggests the possibility of strangulation or peritonitis.
- Abdomen is usually distended.
- Visible intestinal peristalsis (or) colonic peristalsis are sometimes visible through the abdominal wall of these patients with chronic obstructions.
- Surgical scars should be noted. Because of the etiologic implication of previous operations for e.g: the presence of adhesions, neoplasms or Crohn's disease.
- Palpation of the abdomen in simple obstruction may reveal minimal tenderness at upper or lower abdomen.
- Muscle guarding may be elicited during attacks of colic and strangulations.
- Marked tenderness, peritoneal signs, or a palpable mass suggests a closed loop obstruction or strangulation.
- Per rectal examination – mostly empty and may reveal blood, a mass, or a Blummer shelf nodule.

- Per Vaginal examination – might yield evidence of gynaecologic malignancy or an inflammatory lesion.
- Auscultation: High pitched tinkling bowel sounds (Borborygmi) heard in early obstruction. Progressive distention in a late phase of obstruction fatigue of the smooth muscle contraction, peristalsis ceases, and the abdomen becomes relatively quiet. Strangulation and peritonitis are marked by a silent abdomen.
- In case of adynamic ileus, the abdomen is often distended, bowel sounds are scattered without peristaltic rushes and pain and tenderness are usually minimal or absent [7].

DIAGNOSIS

Laboratory Test

The diagnosis of bowel obstruction is not dependent on any set of laboratory findings. Moreover, blood tests are not helpful in differentiating simple from strangulated obstruction. Leukocytosis of greater than 18,000 cells / cmm is suggestive but not confirmatory of strangulation which can also present with leucopenia. Metabolic acidosis, amylase activity, serum phosphate level, creatine kinase, lactate dehydrogenase activity, liver enzyme activity and hematocrit are unreliable predictors of strangulation. Elevated serum amylase activity may be due to

1. A reflux of pancreatic amylase resulting from back pressure from the duodenum.
2. Leakage of intraluminal amylase into the peritoneum with subsequent absorption.
3. Release of intestinal amylase from compromised bowel.

The presence of a significant metabolic acidosis is an ominous sign, yet its sensitivity as an indicator of strangulation is only 75%. Some patients with dead or dying bowel have no base deficit [7].

Creatine kinase determination may be somewhat useful, as it is elevated in 71% of patients with strangulated bowel [7].

Initial fluid shift results in contraction of the extracellular fluid with antidiuresis, renal reabsorption of sodium, a rising blood urea nitrogen level and an increased urine specific gravity.

CRP is elevated in strangulation and ischemia [1].

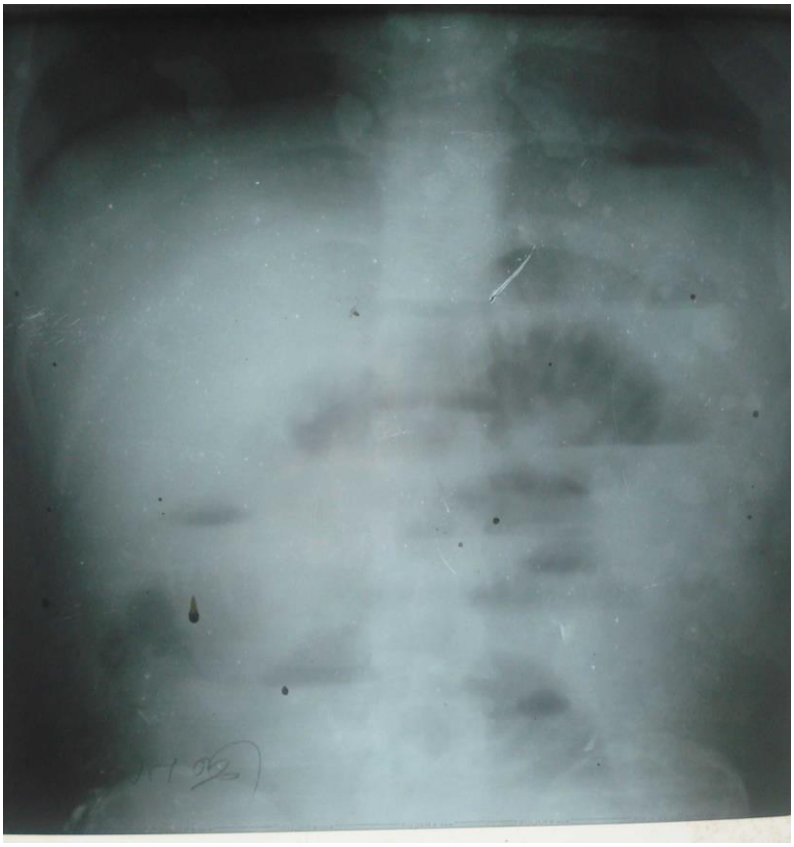
With progressive obstruction and vomiting patients tend to develop hyponatraemia, hypokalemia, metabolic acidosis, hypochloremia and uremia [7].

RADIOGRAPHIC CONFIGURATIONS

Usually the diagnosis of bowel obstruction is first suggested by the history and the physical examination. However, radiologic investigations are valuable, not only in confirming or refuting the diagnosis, but also in determining if the obstruction is high or low, is partial or complete and involves small bowel or large bowel.

Plain Films

In plain radiographic studies are diagnostic in only 46% to 80% of patients, with common occurrence of false-positive and false-negative interpretations, up to 20% of patients may have no radiologic evidence of obstruction [12].



On plain supine and upright radiographs of the abdomen, the cardinal findings that suggest the diagnosis of small bowel obstruction.

1. Accumulation of air and fluid proximal to the point of obstruction.

2. Clearance or absence of fluid and air distal to the obstruction.

3. Dilated loops of small intestine or large intestine.

Dilated loops of small intestine are defined as those larger than 3 cms in diameter. The proximal colon is considered dilated when the diameter reaches 8 to 10 cms and sigmoid colon 5 to 7 cms [7].

The extent of intestinal dilatation is a function not only of the site of obstruction but also of the degree and duration of obstruction. Abdominal radiographs fail to show any abnormal findings in as many as 20% of

patients with proximal intestinal obstruction, especially if the patient has recently vomited and emptied the stomach [7].

Different parts of the bowel have characteristic features as follows:

Jejunum - Valvulae conniventes are seen Concertina / ladder effect.

Ileum - Featureless (wangensteen).

Caecum - Rounded gas shadow in right iliac fossa.

Large bowel - Haustral folds with dimpling on the wall.

Sigmoid volvulus - Bent inner tube appearance / coffee bean appearance.

Small bowel pattern occupies the more central portions of the abdomen whereas the colonic shadow is on the periphery of the abdominal film or in the pelvis.

The plain radiograph may show air in the biliary tree (Pneumobilia) indicative of a biliary enteric fistula. When small bowel obstruction coexists this spectrum of findings is almost pathognomonic of gallstone Ileus.

Signs of strangulation are

i. A fixed loop of bowel that remains stationary in sequential films.
ii. Pseudotumour sign: a fluid filled gangrenous loop appearing as a soft tissue mass.
iii. Pneumatosis Intestinalis.

CONTRAST STUDIES

Contrast studies of the gastro intestinal tract either from above, as with small bowel follow through or enteroclysis or from below with contrast enemas may be helpful. These studies can provide specific localisation of the point of obstruction and may identify the nature of the underlying lesion. It can be useful in differentiating mechanical obstruction from adynamic Ileus.

The most definitive studies are obtained by infusing barium through a tube in the distal duodenum, a procedure known as enteroclysis.

Barium is reported to cause impaction but does not occur in small bowel obstruction though it can convert obstruction in the colon. Barium provides better resolution and causes less cramping and vomiting. Water soluble contrast (gastrograffin) is preferred than barium in case of perforation. It is hyperosmolar and inadvertent aspiration can be lethal. Contrast enemas provide important information in large bowel obstruction where the exact site and cause of obstruction is unclear. Contrast enema performed under carefully controlled conditions (dilute barium, hydrostatic pressures of less than 80 mm Hg) may aid in planning therapy.
Another situation in which a contrast enema is of potential benefit is very distal small bowel obstruction.

COMPUTED TOMOGRAPHY

80-90% Sensitive.

70-90% Specific.

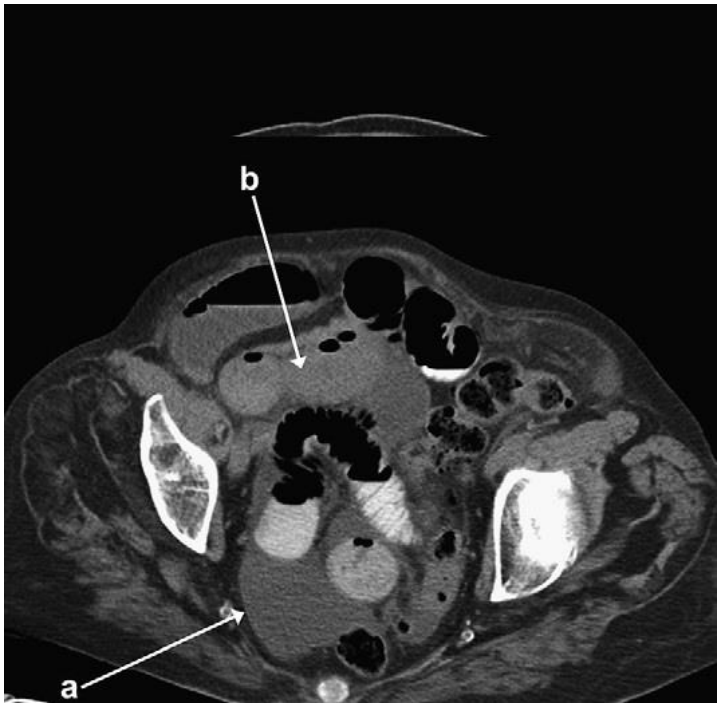
Finding of small bowel obstruction in CT Abdomen (oral and IV contrast)

a. Transition zone : Discrete transition zone with dilatation of bowel proximally, decompression of bowel distally, intraluminal contrast that does not pass beyond the transition zone and a colon containing little gas or fluid.

CECT shows Transition zone

b. Reduced contrast enhancement : Poor or absent contrast enhancement in the bowel wall are also another most specific CT finding for identify vascular impairment in bowel strangulation with a sensitivity of 34% to 48% and a specificity of 100% [11].

c. Ascites fluid (ml): Presence of fluid in the peritoneal cavity.



CECT of an SBO: (a) free fluid, (b) dilated small bowel

d. Target sign : The thickened intestinal wall may sometimes show the target sign owing to submucosal edema or hemorrhage [10].

e. Maximum wall thickness (mm) : CT finding of intestinal wall thickening showed high specificity (88%) with a sensitivity of 54% in characteristic of the simple from strangulated obstruction. Still, the intestinal wall is thinned or rarely invisible when the bowel becomes gangrenous [10].

f. Mesentric fluid : Fluid collection in the mesentery, it may be seen in malignant obstruction, inflammatory bowel disease and peritonitis.

g. Mesentric congestion : Focal congestion of the small bowel mesenteric veins around the site of obstruction.

h. Closed Loop : Closed loop obstruction is suggested by the presence of a ‘U’ shaped or ‘C’shaped dilated bowel loop associated with a radial distribution of mesenteric vessels converging towards a torsion point [8].

i. In-case of cancer, it is useful for staging the disease.

CT scoring system by A.J.Mangram et al. [4]

Initial CT findings	Score
Free air	5
Transition point	3
Complete obstruction	3
Closed Loop	3
Free fluid	3
Partial obstruction	2
Repeat CT findings	Score
Resolution	-5
Improved obstruction	-2
Persistent SBO	+2
Worsening obstruction	+3
Free air	+5

Clinicoradiological score by F.Schwenter et al. [1]

Clinicoradiological criteria	Score points
Pain duration >3days	1
Guarding Present	1
Leucocytosis >10000	1
C-reactive protein >75mg/l	1
CT-Reduced contrast enhancement	1
CT-Free fluid abdomen	1

F.Schwenter et al.'s Clinicoradiological score Interpretations

Score	Interpretations
0	Moderate evidence against resection
1	Moderate evidence against resection
2	Neutral evidence(neither for nor against resection)
3	Weak evidence for resection
4	Strong evidence for resection
5	Strong evidence for resection
6	Strong evidence for resection

ULTRASONOGRAPHY

Abdominal ultrasound has also been projected as an aid in the diagnosis of obstruction of the small bowel and may identify both its location and etiology. Ultrasound can describe extra luminal masses involved with areas of intestinal dilation, more over real time ultrasonography examining blood flow can aid in the diagnosis of strangulation obstruction, where its accuracy may be as high as 90% [8].

MR enteroclysis :

MR imaging has played only a limited role in the clinical evaluation of bowel obstruction. The emerging technique of MR enteroclysis, however, has the potential to change the assessment of the small intestine through its direct multiplanar imaging capabilities, lack of ionizing radiation, functional information and soft tissue contrast that can provide [10].

Compared with CT enteroclysis and MR enteroclysis gives the distinct advantages of direct imaging in the coronal plane and real-time acquisition of functional in sequence. Additionally, the precision of the MR imaging technique does not rely as heavily on fluoroscopist experience as do conventional enteroclysis techniques . To be the primary method of investigation for small intestinal disease, MR enteroclysis has to provide reliable confirmation of normalcy, allow diagnosis of early or subtle structural abnormalities, influence treatment decisions in patients management, and be cost effective [10].

SPECIAL PROCEDURES

1. ENDOSCOPY.

Can reveal obstructing lesions at both proximal and distal ends of the alimentary tract, but despite recent advances, enteroscopy is less efficient in them mesenteric small intestine.

2. PARACENTESIS.

Paracentesis and assay of peritoneal fluid may be of value when the clinical picture is confusing. A finding of white blood cells or bacteria indicates strangulation and would support immediate laparotomy.

3. LAPAROSCOPY:

Laparoscopy can differentiate simple from strangulated obstruction and can occasionally be therapeutic as well. But port placement in distended abdomen is difficult without injuring bowel. When constricting adhesions are accessible and not too dense, laparoscopic lysis may be feasible.

Recent trends suggest that imaging techniques can be useful in detecting strangulation. In rabbits and dogs, radionuclide imaging with technetium diphosphonate showed increased uptake of Isotopes by the Ischemic bowel. Xenon – 133 also has been used to detect early strangulation induced in experimental animals. When instilled intraperitoneally, 133 Xe rapidly disappears from normal animals but there is a significant delay in strangulated obstruction [7].

MANAGEMENT

The fundamental principles involved in management of patients with intestinal obstruction are

1) Resuscitation by correction of hemodynamic and electrolyte imbalance with IV fluids.
2) Bowel rest.
3) Decompression of the gastro intestinal tract by nasogastric tube.
4) Timely surgical intervention.

All patients with suspected strangulation require emergency laparotomy.

Some patients with simple obstruction manage conservatively.

(i) Fluid and electrolyte replacement:

Fluid and electrolyte deficits should be rapidly restored in all patients, however when strangulation is suspected surgical intervention should not be delayed while awaiting complete normalisation. Surgical repair of the injury is resuscitating in itself. Fluids are lost not only externally but also by third space sequestration. The magnitude of these losses cannot be directly measured, and therefore, the adequacy of replacement must be assessed by clinical signs, assisted by central line monitoring, pulse rate, blood pressure and urine output.

In the elderly and in patients suspected of harbouring gangrenous bowel, a Swan Ganz catheter is essential to record pulmonary capillary wedge pressure, cardiac output, and mixed venous oxygen saturation. Changes in blood composition take much longer to correct than do volume losses.

Profound hypokalaemia, may require up to 24 hours to reverse. Serum electrolyte and acid base determinations help guide the choice of fluids to be administered. If gastric acid loss predominates, normal saline is used, but for most bowel obstructions, lactated Ringer's solution is more appropriate fluid.

Intra vascular volume is restored with crystalloid solutions, the hematocrit can be expected to drop with strangulation. A significant amount of blood may be lost into the bowel and peritoneal cavity and this should be replaced by packed cell transfusion as needed.

(ii) Intubation:

All patients with intestinal obstruction require aspiration of gastro intestinal contents, through either a short or long tube.

The most popular tubes are nasogastric tubes.

Nasogartric tubes helps by,

1. Decompressing the stomach and the most proximal intestine.

2. Preventing distension by swallowed air.

3. Minimizing the risk of aspiration.

Tubes are either long (e.g: miller abbot) or short (non vented Ryle's and vented salem). Long tubes like miller abbot are of the double type with a channel for aspiration and with a balloon at the other end for advancement.

Long tubes may be useful initially to treat small bowel obstruction, particularly when the nasogastric suction has failed; intra operatively to decompress more distal bowel and to identify points of intrinsic obstruction and postoperatively to stent the bowel.

ANTIBIOTICS

Antibiotics do not alter the course of simple obstruction but are administered preoperatively because of the possibility of inadvertent enterostomy and attendant peritoneal soilage, which might result in intra abdominal abscess or wound infection.

In cases of suspected or known strangulation, potentially pathogenic translocated bacteria and toxins can be life threatening and antibiotic therapy is essential.

Antibiotics selection should be from among those effective against both aerobic gram negative bacilli and anerobes such as bacteroides. A reasonable choice in intestinal obstruction might be a second generation cephalosporin such as cefoxitin or cefotetan or a synthetic penicillin, in combination with β lactamase inhibitor (eg: ampicillin and sulbactam). Because of the life threatening sepsis that occurs in strangulation, it may be advisable to add an aminoglycoside, such as gentamicin.

Monoclonal antibodies directed against endotoxins from gram negative bacteria have been developed. HA-1A and E5 are examples of immunoglobulin M antibodies used in current trials in patients experiencing shock due to complicated bowl obstruction [7].

ROLE OF EXPECTANT NON OPERATIVE MANAGEMENT

Surgery may be delayed under certain circumstances.

1. Post operative obstruction

Distension, vomiting and failure to pass flatus early after abdominal surgery are usually due to transient (physiologic) ileus, but mechanical obstruction can also follow intra abdominal operations. However overlooked strangulation remains a potential risk.

2. Later Post operative obstruction

A special situation involves small bowel obstruction that develops 10 days to 4 weeks after a previous celiotomy. This window of time represents the most dangerous time for reoperation because the adhesions forming from previous celiotomy can be extremely thick, intense and vascular. Strong consideration should be given to a primary non-operative approach with a planned gastric decompression for 3 to 6 months (by a percutaneous endoscopic gastrostomy or even a tube pharyngostomy) and parenteral nutritional support [8].

3. Intussusception

Infants with ileocaecal intussusception usually respond to a controlled hydrostatic reduction of the intussusception, which avoids operation entirely.

4. Sigmoid Volvulus

In patients with sigmoid volvulus sigmoidoscopy or colonoscopy can achieve decompression of the obstructed sigmoid loop.

5. Crohn's disease

In patients with intestinal obstruction due to an acute exacerbation of crohn's disease, a period of conservative medical treatment with systemic steroids or other anti inflammatory agents may lead to resolution of the obstruction and prevent the need for operative intervention.

6. Partial Obstruction

Patients with partial small bowel obstruction may be managed by less urgent operative treatment than patients with acute complete obstruction. If a patient has already undergone multiple operations for obstruction due to adhesions, further operation may carry little prospect of success and can be hazardous if the bowel is opened inadvertently.

Conservative Therapy is Contraindicated in

1. Suspected strangulation.
2. Closed loop obstruction.
3. Hernia complicated by obstruction.
4. Small bowel obstruction without an abdominal scar or hernia.

SURGICAL MANAGEMENT

The most critical decision in managing obstruction is distinguishing between simple and strangulated intestinal obstruction. A commonly saying is the “sun should never rise and set on a complete small bowel obstructions”.

There is no single clinical sign (or) diagnostic test that accurately diagnoses strangulation. Rarely does a patient exhibit all the signs of strangulation viz.,

Fever

Tachycardia

Localised abdominal pain

Guarding

Leukocytosis

However, in the absence of all these signs, dead on dying bowel is found in less than 10% of cases. No improvement by 48 hours or clinical deterioration at any time mandates emergency surgery is requiring [7].

When the exact cause of the obstruction is unknown, a suitable incision, most often midline is essential. It is necessary to determine the

1. Site of obstruction.

2. Nature of Obstruction.

3. Bowel viability.

The cecum is the best guide to the site of obstruction. If collapsed, the obstructive lesion lies proximally and if distended, then a colonic lesion is likely. From the ileocaecal junction the small bowel is traced upwards following the collapsed loop to the junction. With the distended loops where the obstructive lesions should lie.

The assessment of bowel viability may sometimes be difficult. The problem that the surgeon faces is,

1. Determining the viability in borderline cases.

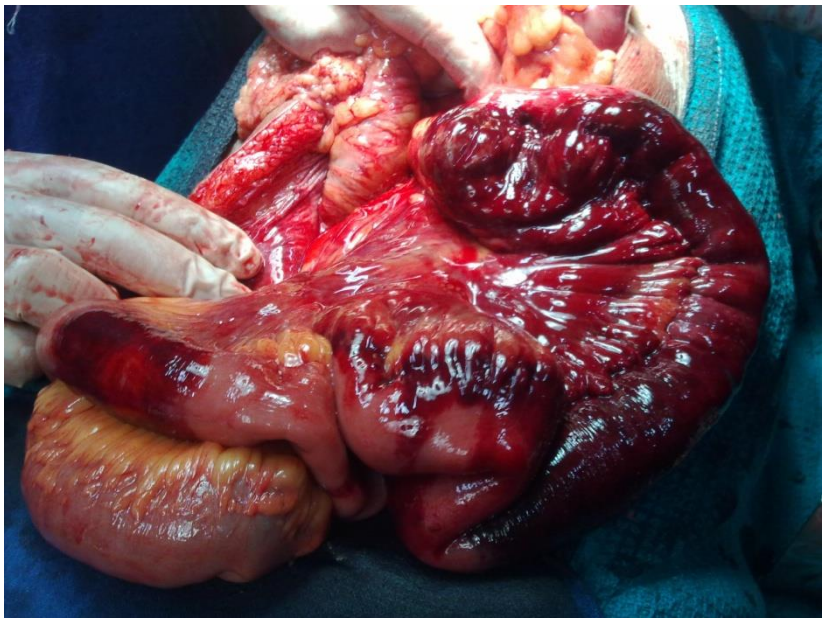
2. Delineating the extent of involvement. Obviously ischemic bowel is

i. Greenish black in appearance.

ii. No peristalsis and complete atony.

iii. Absence of bleeding from cut surfaces.

iv. Absent pulsations in the vasa recta and mesenteric vessels.



Intra operative methods of determining the viability of the bowel include use of Doppler flow to measure blood flow in the anti mesenteric border, and injecting intravenous fluorescein and examining the bowel with woods lamp.

When the bowel viability is undeterminable then it would be safer to exteriorize both ends. This allows daily inspection of the circulatory status of the exteriorized ends. When doubt remains regarding a segment of a bowel, a second look operation may be carried out 24 hours later [7].

The nature of surgical procedure depends on the cause

a. Adhesions – Adhesiolysis.
b. Obstructed hernia – Reduction of the herniated bowel and closure of the defect.
c. Malignant tumour of small bowel: if feasible, primary resection and anastomosis can be done. Otherwise a simple bypass to relieve the obstruction as an emergency procedure.
d. Inflammatory bowel disease: Bowel resection (or) stricturoplasty if non operative treatment fails.
e. Intra abdominal abscess: CT guided drainage is usually sufficient to relieve obstruction.
f. Radiation enteritis: Possible resection of irradiated bowel or bypass of the affected area.

g. Intussusception: < 24 hrs – hydrostatic reduction, > 24 hrs – resection and anastomosis.
h. Recurrent intestinal obstruction: It is usually due to adhesions. Adhesiolysis is difficult, hence Plication operation is indicated. Anti adhesive agents like 5% polyethylene glycol can be used.

RECENT ADVANCES

ROLE OF LAPARASCOPY IN THE MANAGEMENT OF BOWEL OBSTRUCTION

Today, laparoscopy is being applied to a number of obstructing small bowel and colonic processes, such as relief of small bowel obstruction secondary to adhesions, foreign body removal, bypass procedures for malignant and benign disease causing intestinal obstruction, resection for appendicitis or a meckel's diverticulum causing intestinal obstruction and evaluation and resection for inflammatory bowel disease (ie. crohn's disease).

Laparoscopic treatment of small bowel obstruction if successful leads to a shorter hospital stay and quicker rehabilitation of the patient and has good long term results. With further experience, laparoscopic

exploration is an excellent diagnostic modality in acute small bowel obstruction and may allow a fully laparoscopic adhesiolysis with relief of the intestinal obstruction.

Patients with complete or distal small bowel obstruction are not candidates for laparoscopic management. (22)

Conclusion of Literature review

In conclusion, most of the recent advances in the management of bowel obstruction consist of developments in the imaging modalities available to assist in the diagnosis itself, particularly with regard to the distinction between partial and complete obstruction. Unfortunately little progress has been made to enable physicians to detect early reversible strangulation. Because of the inability to detect reversible ischemia, there is a substantial risk of progression to irreversible ischemia when surgery is delayed for an extended period of time, especially in the setting of suspected complete obstruction.

It is encouraging, that some advances have been made in understanding the patho physiology and prevention of adhesion formation. Research efforts in the future should continue to focus on these issues as well as on the development of methods to better recognize early signs of strangulation.

MARERIALS AND METHODS

Patients and Methods

Between January 2012 to November 2012, All patients who presented at the emergency surgical ward of Stanley Medical college and Hospital, Chennai with clinical symptoms of acute intestinal obstruction was admitted and evaluated for intestinal obstruction. The study was conducted in accordance with our institutional ethical committee guidelines.

Inclusion criterias

All patients underwent laparotomy for small intestinal obstruction with all investigations such as blood urea, Serum creatinine, complete blood count and level of C-reactive protein, plain abdominal X-Rays and contrast CT abdomen.

Exclusion criterias

Obstructed or strangulated hernias,

Incarcerated abdominal wall hernias,

Immediate (within one month) postoperative ileus,

Inflammatory bowel disease,

Iradiation-induced intestinal fibrosis

Peritoneal carcinomatosis,

Large bowel obstructions,

Patients not fit for contrast CT abdomen

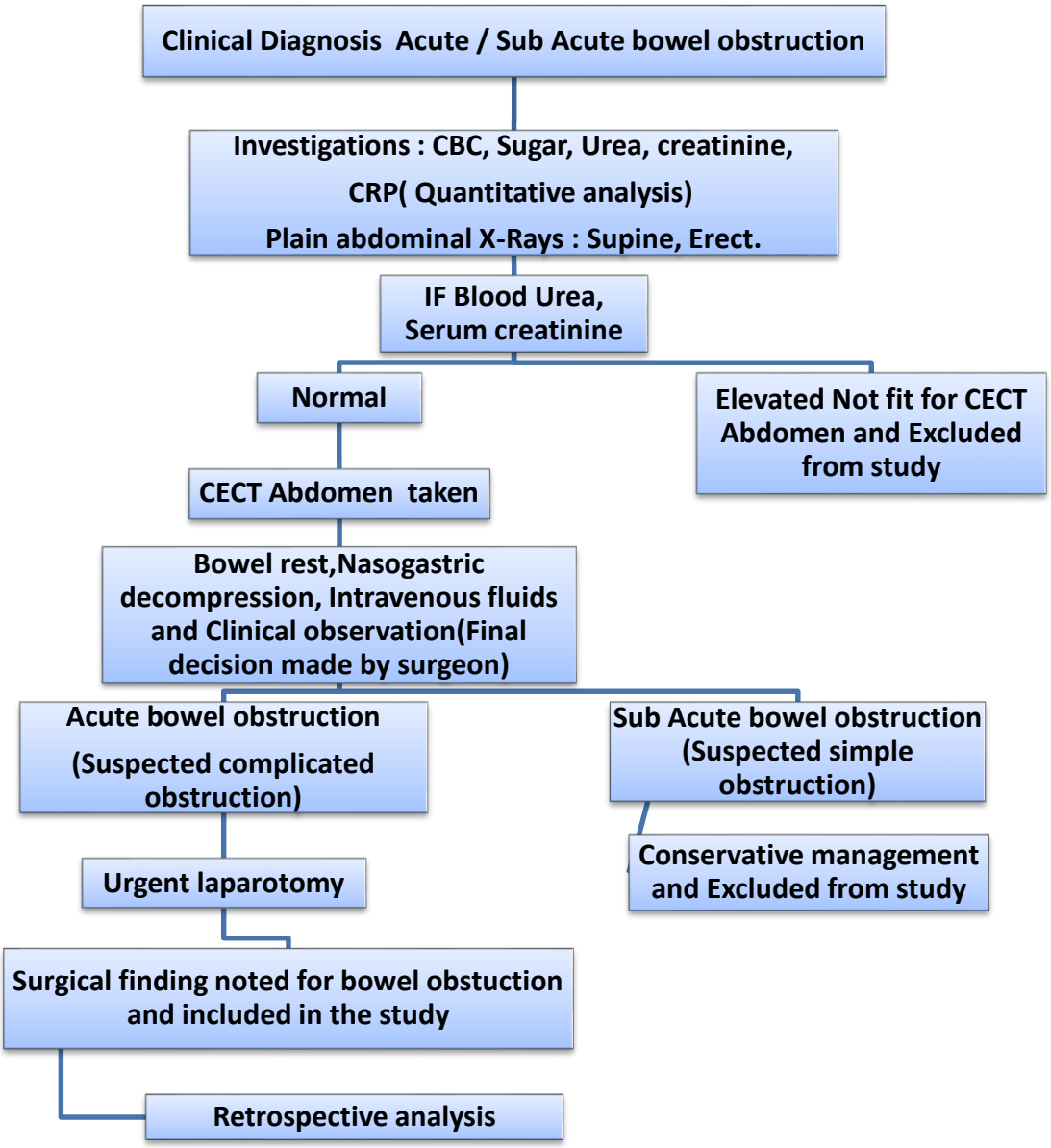
Conservative groups of intestinal obstructions,

Patients underwent laparotomy after 24 hours of admission.

After documentation of the history, clinical evaluation included physical examination with determination of fever and peritoneal signs(guarding), blood tests for blood urea, Serum creatinine, complete blood count and level of C-reactive protein, plain abdominal X-Rays and contrast CT abdomen for all patients diagnosed as intestinal obstruction.

All the examinations were performed on a CT scanner (THOSIBA). Oral contrast material was not administered. The acquisition of information was helical in our cases. The examinations started with a plain abdomen study before IV contrast material injection. A volume of 40–60 ml of IOHEXOL 350 mg/ I ml was injected for the all patients without medical contraindication. The delay between the start of injection and imaging varied between 30 and 60 sec. The slice thickness was 5 or 8 mm, the pitch was 1.4, and the reconstruction interval was 4 or 6 mm.

Methods of study



Based on clinical judgment, patients with suspected simple obstruction were managed conservatively treated with bowel rest, nasogastric decompression and intravenous fluids and excluded from the study.

Patients with clinically suspected complicated obstruction planned for urgent laparotomy and operative finding were recorded and included in the study. The diagnosis of intestinal obstruction was made at laparotomy with macroscopic evidence of ischaemia or uncertain viability requiring bowel resection. Another category of patients underwent laparotomy and requiring only adhesiolysis done. In all cases the final decision was taken by the surgeons for laparotomy, only by clinical findings.

Over an 11-month period 104 patients clinically diagnosed as acute or sub acute bowel obstruction was admitted in our hospital in which 61 patients are excluded from our study for above exclusion criterias. In our study 43 patients are included and they fulfil our inclusion criterias.

Demographic data was collected for name, age (data divided into <25, >25-50, >50 years) and sex. Clinical variables are duration of abdominal pain before admission (data divided into 1, 2-3, >3 days), temperature was recorded, and clinical signs such as guarding was present or absent were noted.

Laboratory variables taken were leucocyte count was noted (> 10000 cells/cu.mm and <10000 cells/cu.mm) and C- reactive protein(data divided into >75mg/l and <75mg/l).

CT scan variables included in presence of a Transition zone, Reduced contrast enhancement, Maximum wall thickness of intestine (>3mm and<3mm), Maximum diameter of intestine(>4cms and <4cms), Free fluid abdomen(>500ml and <500ml) and presence of free air in abdomen were noted by radiologist blinded to surgical outcomes.

There were three surgical outcome categories:

1. No evidence of intestinal ischaemia and adhesiolysis done.

2. Evidence of uncertain viability of intestine and bowel resection performed.

3. Evidence of ischaemia of intestine and bowel resection performed.

The reference standard for all features of this study was visual inspection of the bowel by surgeons at the time of surgery.

RESULTS, OBSERVATIONS &CHARTS

Between January 2012 to November 2012, 43 patients were included in the study. There were 30 men (69.76%) and 13 female (30.23%) with a median age of 52 (range 19-77) years.

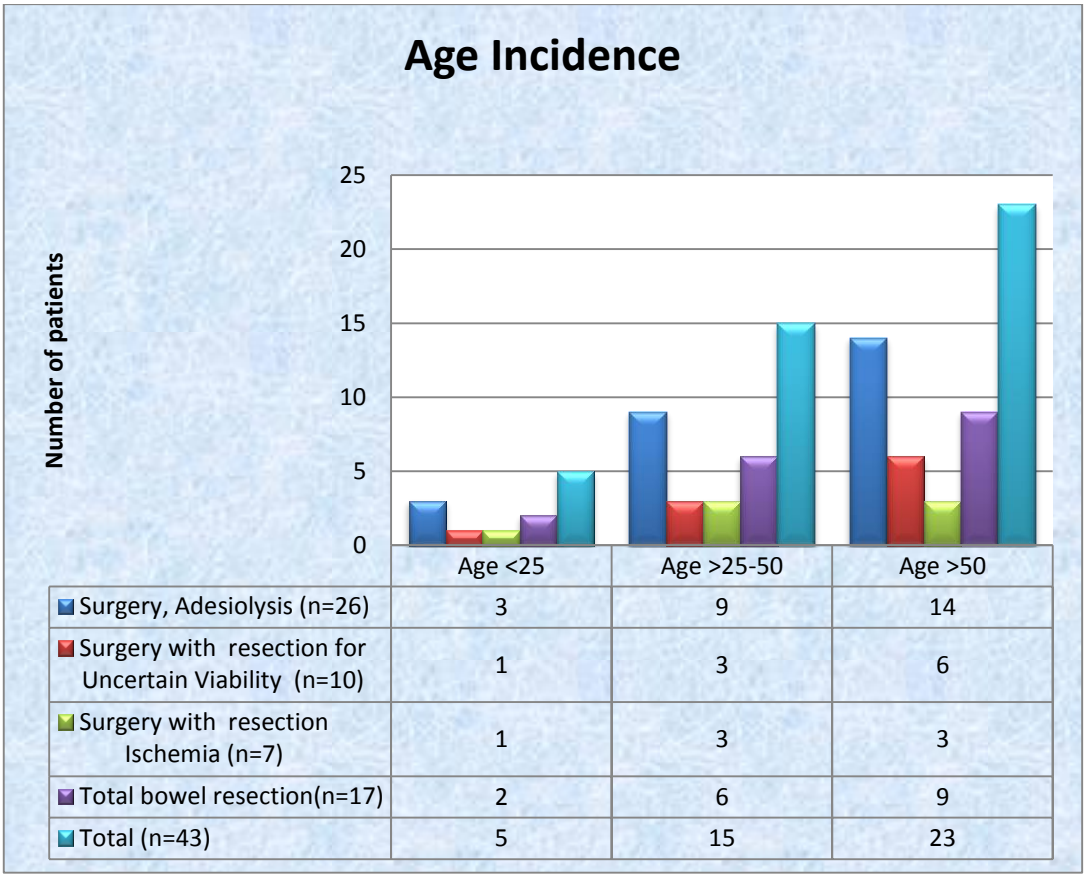
Thirty-six(84%) patients had undergone previous intraabdominal surgeries, including 7 appendectomies, 6 cholecystectomies, 7 gastroduodenal surgeries, 5 small bowel resection, 4 colectomies, 4 gynecological surgeries, one nephrectomy, one splenectomy and one abdominal cocoon.

Forty- three patients undergone laparotomy for small bowel obstruction in which 17(40%) patients underwent bowel resection in which 7(16%) patients with bowel ischaemia and 10(23%) patients with uncertain viability of bowel. In other 26(60%) patients underwent adhesiolysis for bowel obstruction and no signs of ischaemia.

RESULTS OF OUR STUDY (* Percentage in bracts)

	Surgery, No resection Adhesiolysis (n=26)	Surgery with resection			Total number of Patients in study (n=43)
		Uncertain Viability (n=10)	Ischemia (n=7)	Total bowel resection(n=17)	
Sex					
Male	**17(65.38)**	**8(80.00)**	**5(71.42)**	**13(76.47)**	**30(69.76)**
Female	**9(34.61)**	**2(20.00)**	**2(28.57)**	**4(23.52)**	**13(30.23)**
Age					
<25	**3(11.53)**	**1(10.00)**	**1(14.28)**	**2(11.76)**	**5(11.62)**
>25-50	**9(34.61)**	**3(30.00)**	**3(42.85)**	**6(35.29)**	**15(34.88)**
>50	**14(53.84)**	**6(60.00)**	**3(42.85)**	**9(52.94)**	**23(53.48)**
Pain duration					
1 day	**10(38.46)**	**2(20.00)**	**0(00.00)**	**2(11.76)**	**12(27.90)**
2-3days	**13(50.00)**	**6(60.00)**	**1(14.28)**	**7(41.17)**	**20(46.51)**
>3days	**3(11.53)**	**2(20.00)**	**6(85.71)**	**8(47.05)**	**11(25.58)**
Fever(F)					
>100	**4(15.38)**	**2(20.00)**	**5(71.42)**	**7(41.17)**	**11(25.58)**
<100	**22(84.61)**	**8(80.00)**	**2(28.57)**	**10(58.82)**	**32(74.41)**
Guarding					
Present	**16(61.53)**	**9(90.00)**	**5(71.42)**	**14(82.35)**	**30(69.76)**
Absent	**10(38.46)**	**1(10.00)**	**2(28.50)**	**3(17.64)**	**13(30.23)**
Leucocytosis					
>10000	**17(65.38)**	**8(80.00)**	**7(100.00)**	**15(88.23)**	**32(74.41)**
<10000	**9(34.61)**	**2(20.00)**	**0(00.00)**	**2(11.76)**	**11(25.58)**
C-reactive protein					
<75mg/l	**19(73.07)**	**4(40.00)**	**1(14.28)**	**5(29.41)**	**24(55.81)**
>75mg/l	**7(26.92)**	**6(60.00)**	**6(85.70)**	**12(70.58)**	**19(44.18)**
CT-Transition zone					
Present	**25(96.15)**	**10(100.00)**	**6(85.70)**	**16(94.11)**	**41(95.34)**
Absent	**1(3.84)**	**0(00.00)**	**1(14.28)**	**1(5.88)**	**2(4.65)**
CT-Reduced contrast enhancement					
Present	**3(11.53)**	**7(70.00)**	**7(100.00)**	**14(82.35)**	**17(39.53)**
Absent	**23(88.46)**	**3(30.00)**	**0(00.00)**	**3(17.64)**	**26(60.46)**
CT-Maximum wall thickness of intestine (mm)					
>3mm	**5(19.23)**	**1(10.00)**	**3(42.85)**	**4(23.52)**	**9(20.93)**
<3mm	**21(80.76)**	**9(90.00)**	**4(57.14)**	**13(76.47)**	**34(79.06)**
CT-Maximum diameter of intestine(cm)					
>4cm	**6(23.07)**	**0(00.00)**	**4(57.14)**	**4(23.52)**	**10(23.25)**
<4cm	**20(76.92)**	**10(100.00)**	**3(42.85)**	**13(76.47)**	**33(76.74)**
CT-Free fluid abdomen					
>500ml	**10(38.46)**	**7(70.00)**	**5(71.41)**	**12(70.58)**	**22(51.16)**
<500ml	**16(61.53)**	**3(30.00)**	**2(28.57)**	**5(29.41)**	**21(48.83)**
CT-Free air in abdomen					
Present	**0(00.00)**	**0(00.00)**	**5(71.41)**	**5(29.41)**	**5(11.62)**
Absent	**26(100.00)**	**10(100.00)**	**2(28.57)**	**12(70.58)**	**38(88.37)**

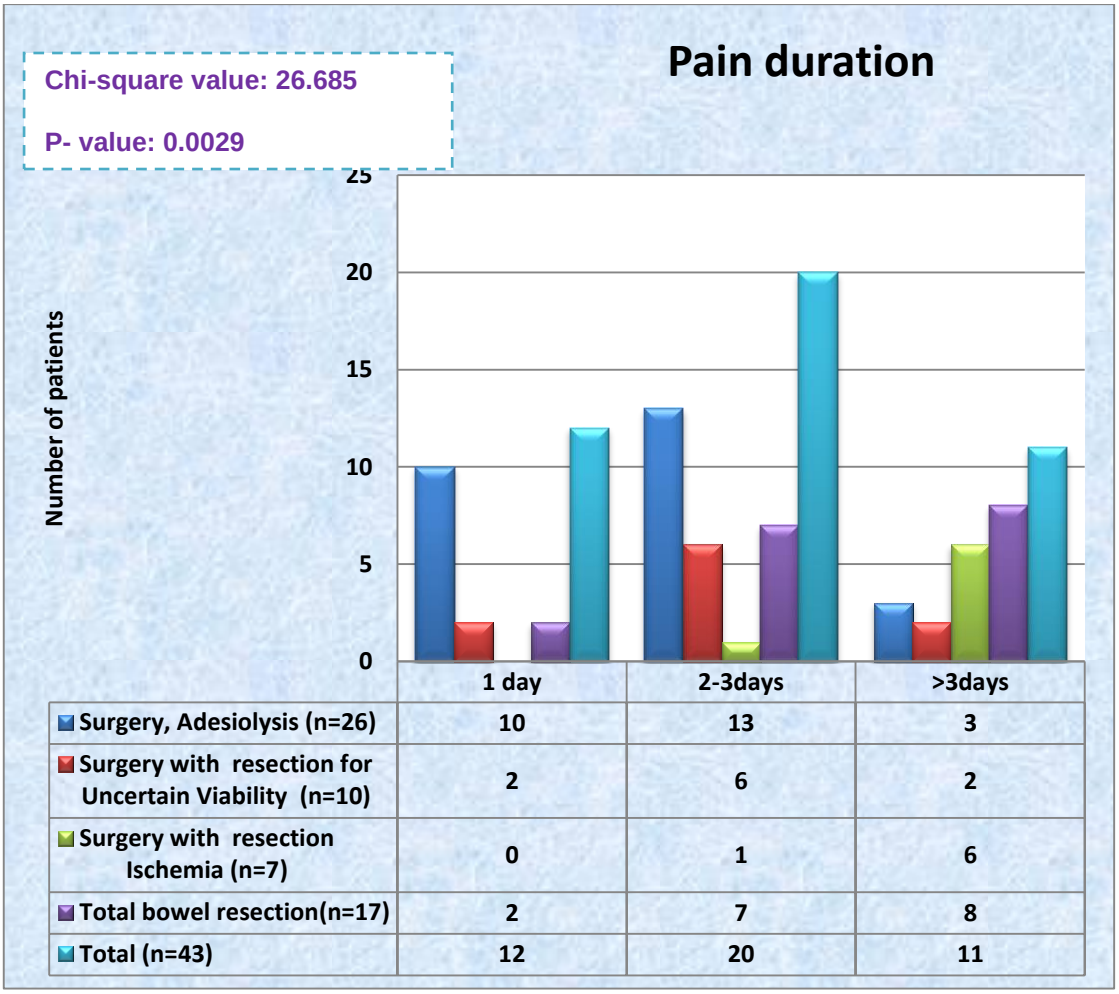
Age Incidence



	Age <25	Age >25-50	Age >50
Surgery, Adesiolysis (n=26)	3	9	14
Surgery with resection for Uncertain Viability (n=10)	1	3	6
Surgery with resection Ischemia (n=7)	1	3	3
Total bowel resection(n=17)	2	6	9
Total (n=43)	5	15	23

In age incidence most of the patients were above 50(53.48%) years. In which bowel resection was done in 9 (52.94%) patients. In our study more than 50 years patients are in more the risk of bowel strangulation .

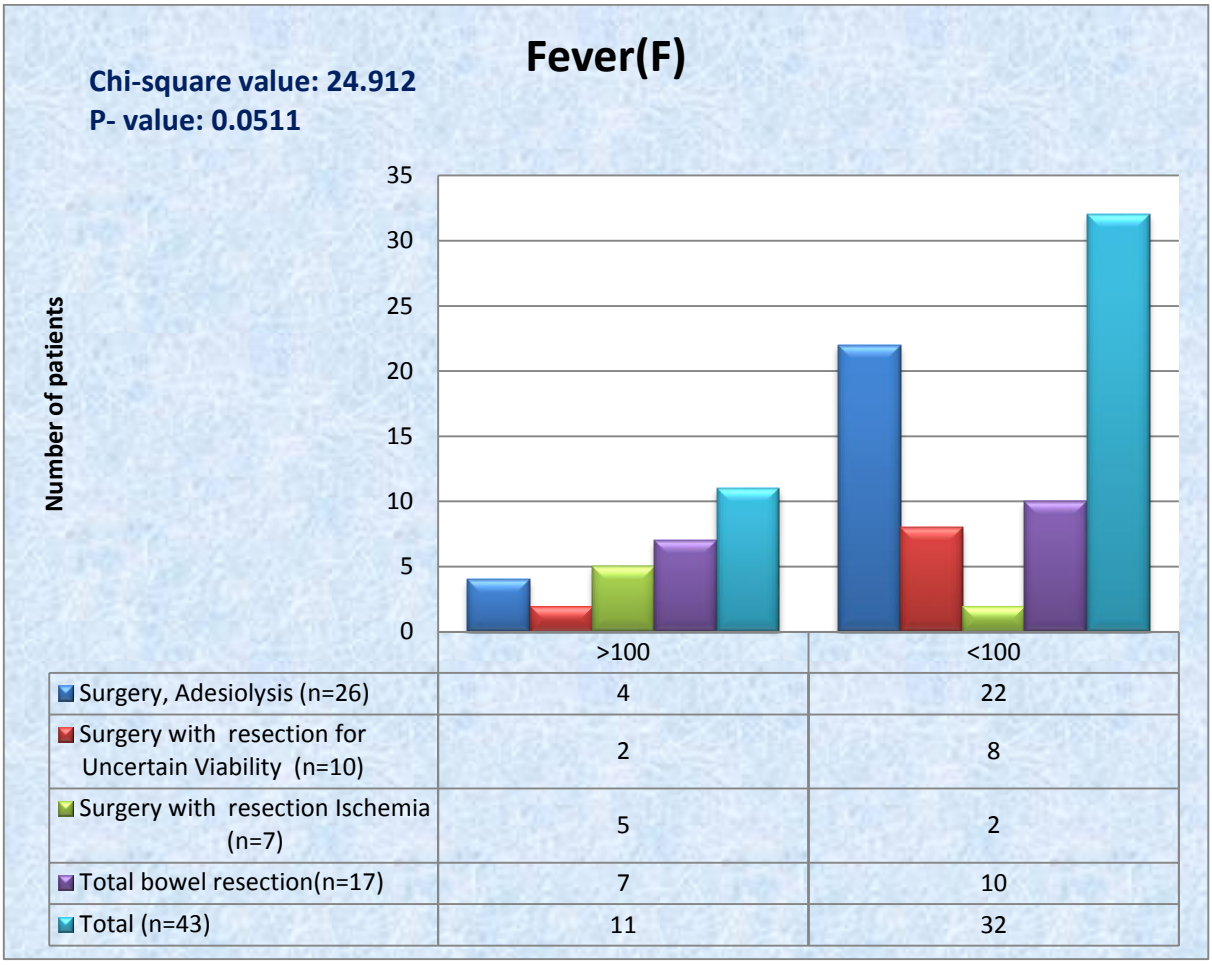
Pain Duration



	1 day	2-3days	>3days
Surgery, Adesiolysis (n=26)	10	13	3
Surgery with resection for Uncertain Viability (n=10)	2	6	2
Surgery with resection Ischemia (n=7)	0	1	6
Total bowel resection(n=17)	2	7	8
Total (n=43)	12	20	11

In our study most of the patients presented with 2-3days abdominal pain for 20(46.51%) patients. More than 3 days of abdominal pain was more risk of bowel strangulation for 8(47.05%) patients in bowel resection category.

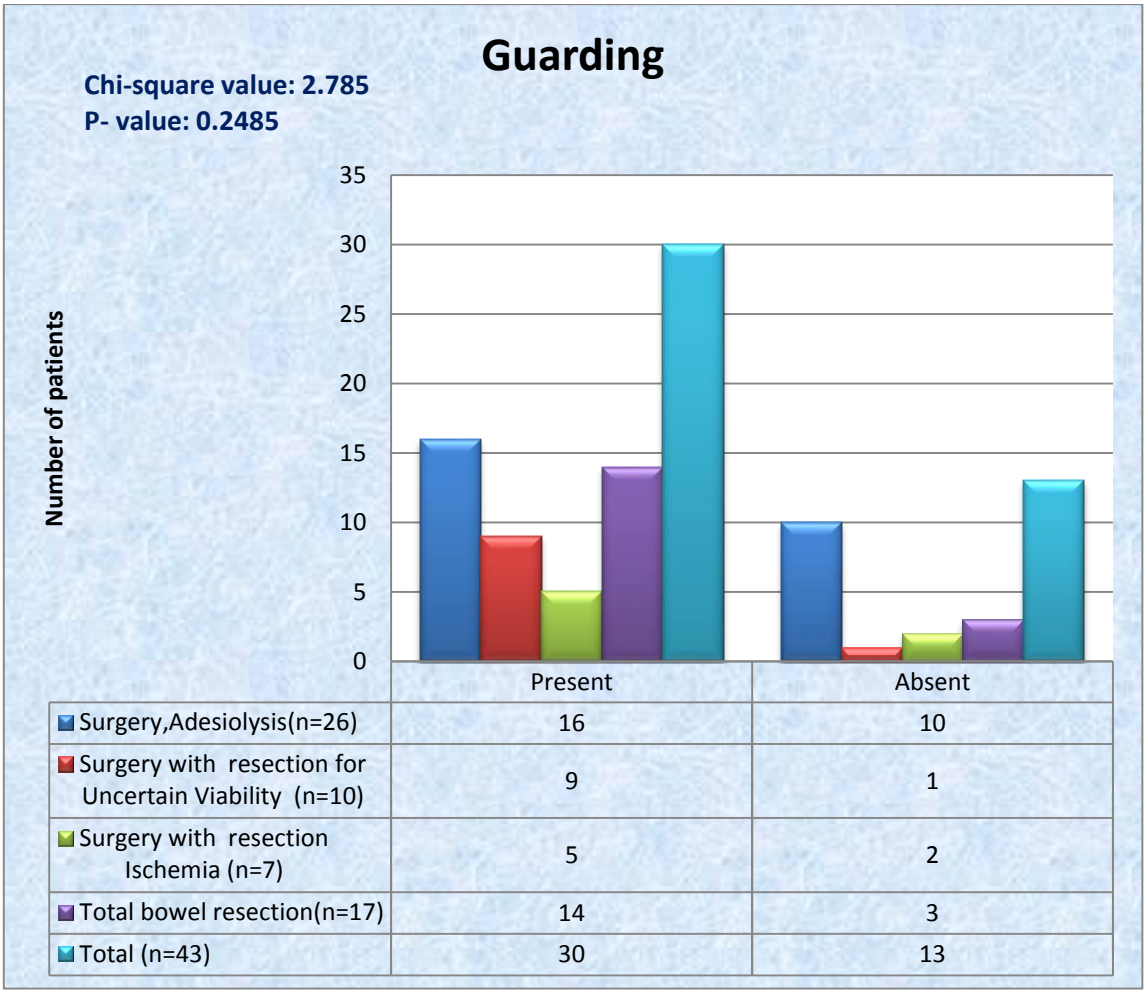
Incidence of Fever:



	>100	<100
Surgery, Adesiolysis (n=26)	4	22
Surgery with resection for Uncertain Viability (n=10)	2	8
Surgery with resection Ischemia (n=7)	5	2
Total bowel resection(n=17)	7	10
Total (n=43)	11	32

In our study fever variables are more than 100F and less than 100F. In which 32(74.41%) patients presented with less than 100F. Temperature is insignificant for predicting the risk of bowel obstruction and strangulation. 7(41%) patients with more than 100F had underwent bowel resection.

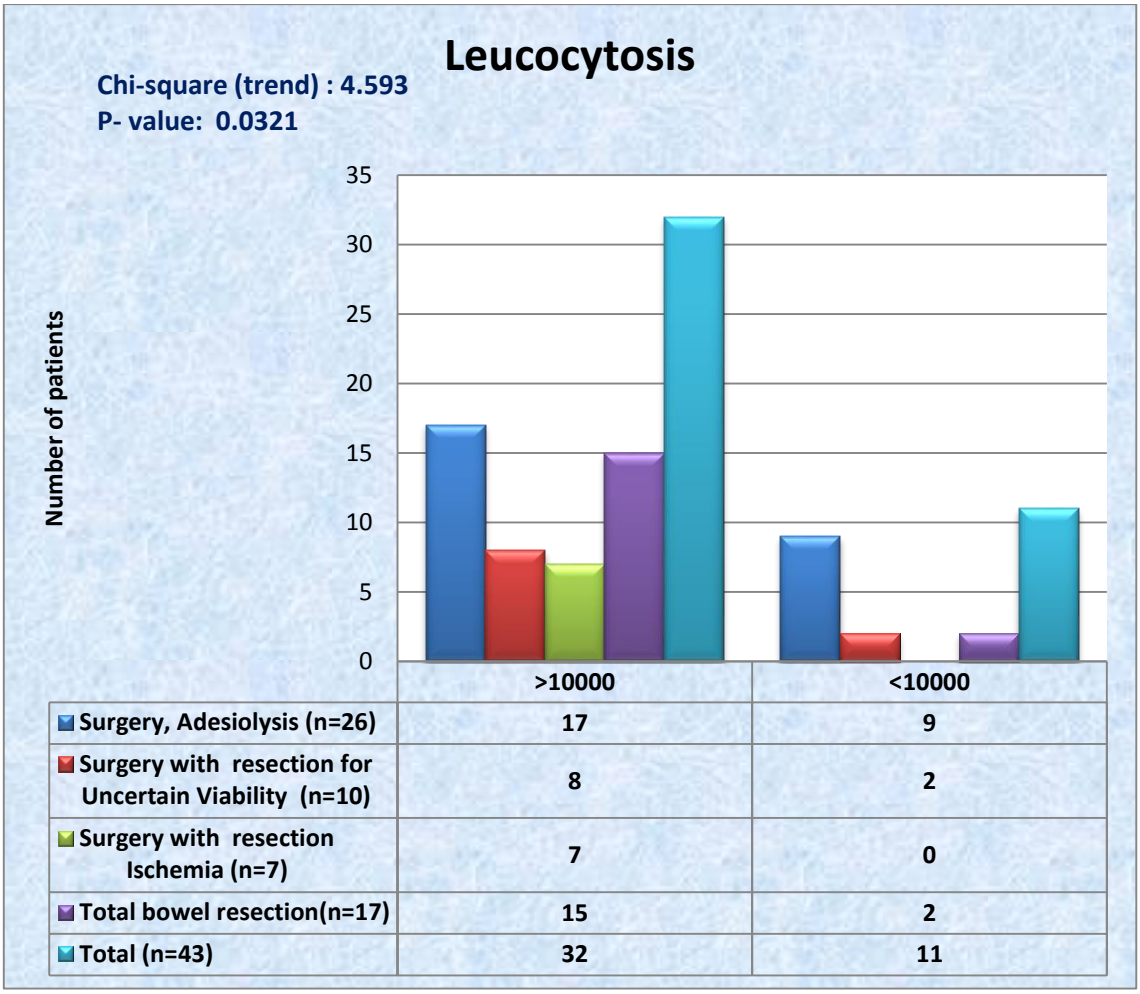
Incidence of Guarding:



	Present	Absent
Surgery,Adesiolysis(n=26)	16	10
Surgery with resection for Uncertain Viability (n=10)	9	1
Surgery with resection Ischemia (n=7)	5	2
Total bowel resection(n=17)	14	3
Total (n=43)	30	13

In our study most of the patients presented with guarding for 30(69.76%) patients. In incidence of guarding our study is insignificant (P=0.2485) for predicting the risk of bowel obstruction and strangulation. But guarding was present in 14(82%) patients in bowel resection category.

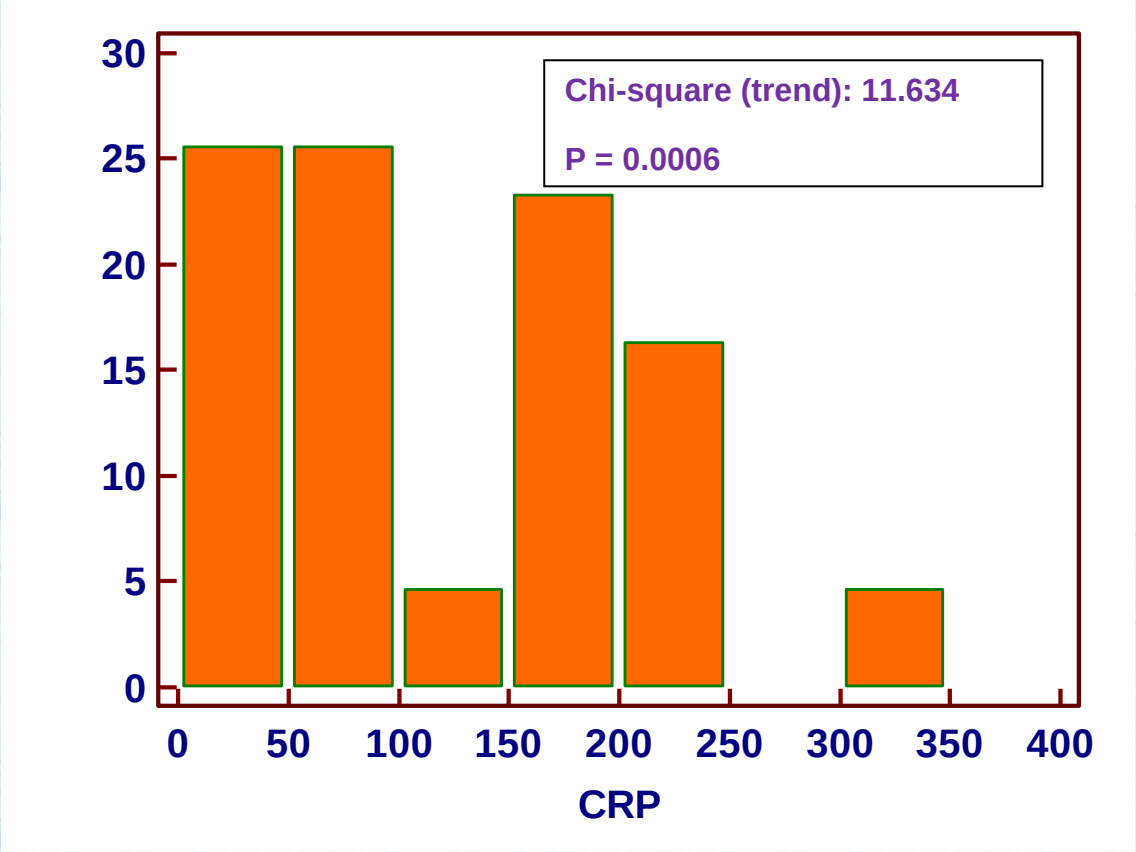
Incidence of Leucocytosis



	>10000	<10000
Surgery, Adesiolysis (n=26)	17	9
Surgery with resection for Uncertain Viability (n=10)	8	2
Surgery with resection Ischemia (n=7)	7	0
Total bowel resection(n=17)	15	2
Total (n=43)	32	11

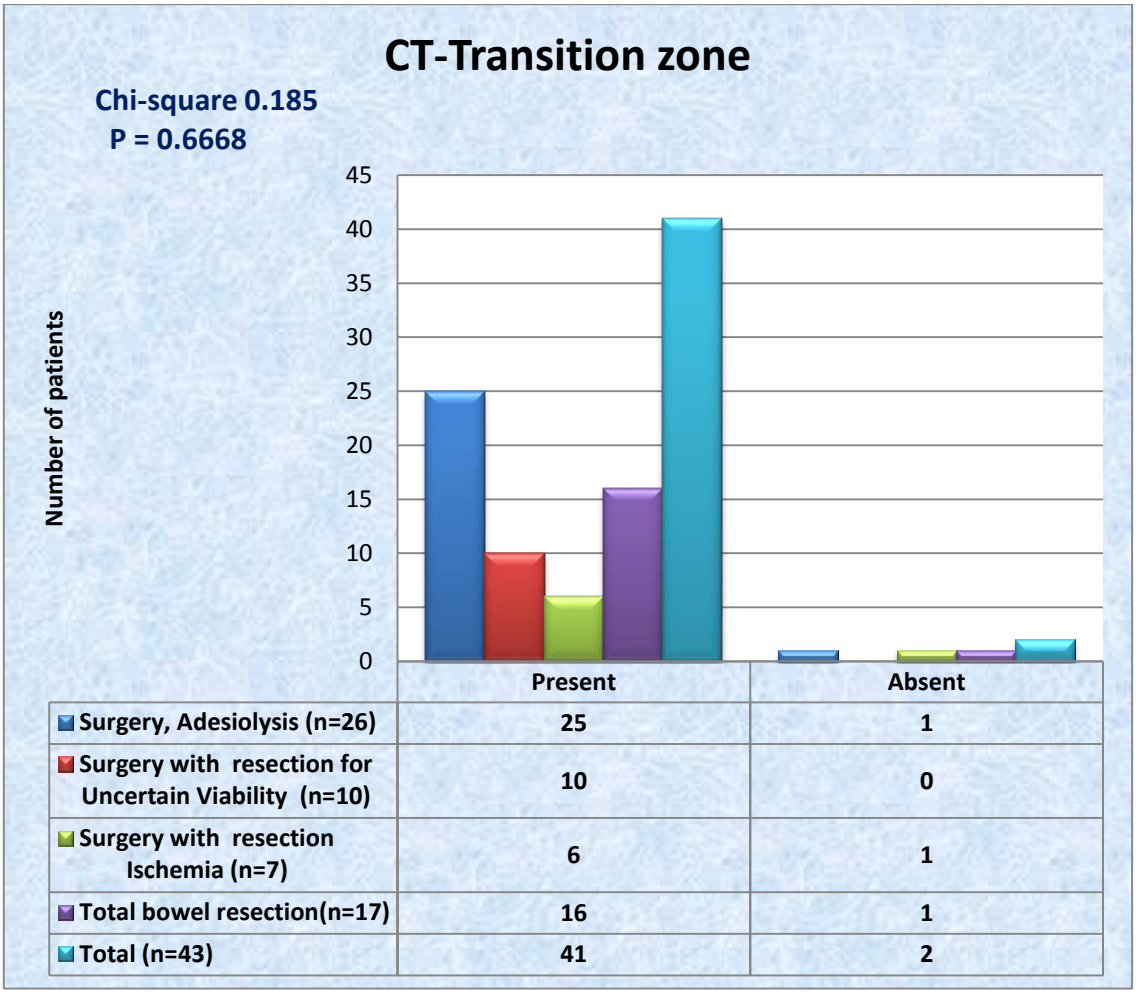
In our study most of the patients presented with leucocytosis more than 10000cu.mm for 32 (74.41%) patients. In which 15 patients presented with strangulation and underwent bowel resection in bowel resection category.

Elevation of C-reactive protein:



In our study mean CRP value is 120mg/l, out of 17 strangulated patients CRP more than 75 in 12(70.58%) patients. So risk of bowel strangulation and ischemia more in higher CRP value. P value is significant for predicting the risk of strangulation and ischemia.

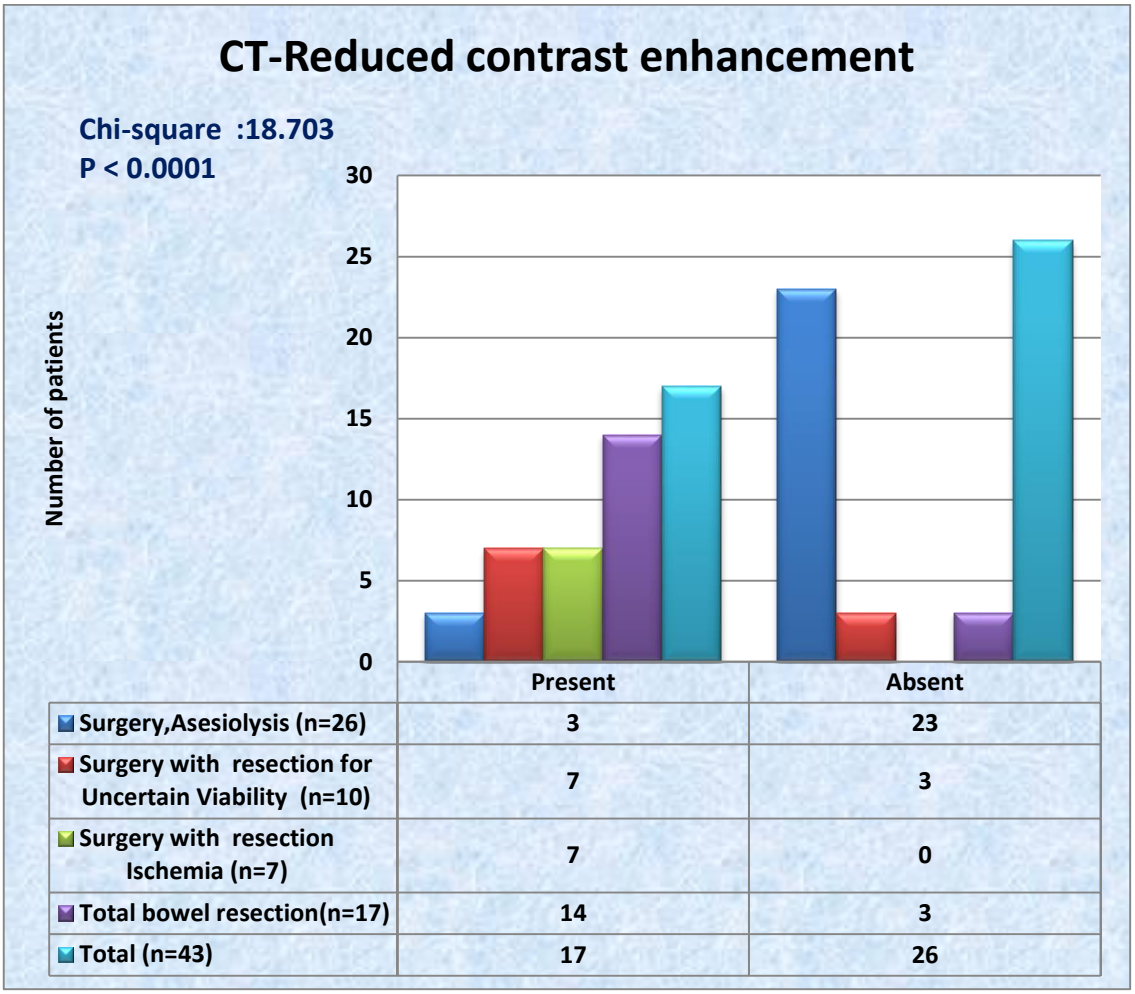
CT-Transition zone in bowel obstruction:



	Present	Absent
Surgery, Adesiolysis (n=26)	25	1
Surgery with resection for Uncertain Viability (n=10)	10	0
Surgery with resection Ischemia (n=7)	6	1
Total bowel resection(n=17)	16	1
Total (n=43)	41	2

In our study CT-Transition zone was Present in 41(95.34%) patients with bowel obstruction. So this CT sign is only predicting the risk of bowel obstruction, not for strangulation or ischemia.

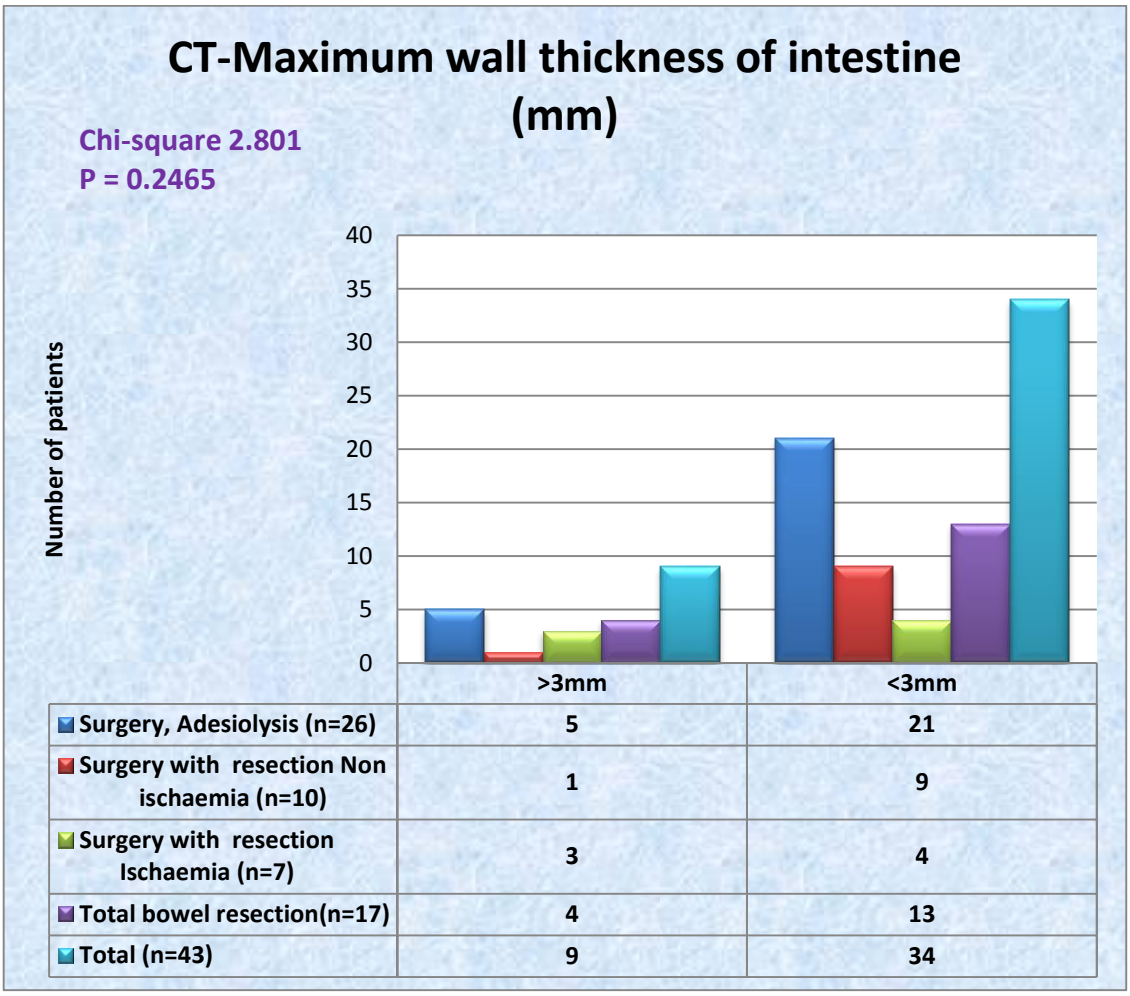
CT-Reduced contrast enhancement in bowel obstruction:



	Present	Absent
Surgery,Asesiolysis (n=26)	3	23
Surgery with resection for Uncertain Viability (n=10)	7	3
Surgery with resection Ischemia (n=7)	7	0
Total bowel resection(n=17)	14	3
Total (n=43)	17	26

In our study reduced contrast enhancement of bowel wall in CECT is more significant in predicting the risk of bowel strangulation and ischemia. Out of 17 bowel resections 14(82.35%) patients had reduced contrast enhancement of bowel wall in CECT. In ischemia all patients had reduced contrast enhancement of bowel wall in CECT.

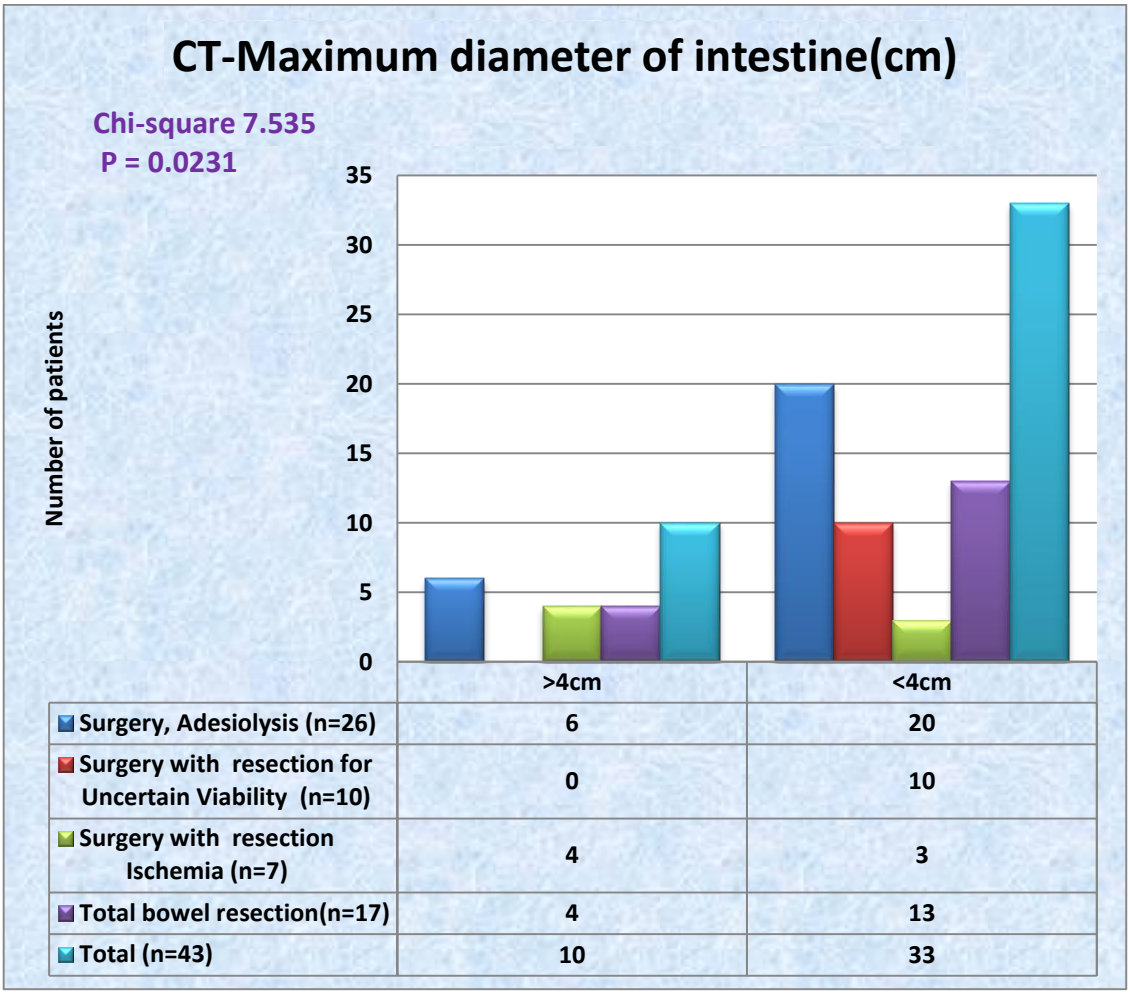
CT-Maximum wall thickness of intestine in bowel obstruction:



	>3mm	<3mm
Surgery, Adesiolysis (n=26)	5	21
Surgery with resection Non ischaemia (n=10)	1	9
Surgery with resection Ischaemia (n=7)	3	4
Total bowel resection(n=17)	4	13
Total (n=43)	9	34

In our study maximum wall thickness of intestine in CECT of bowel obstruction are less than 3mm in 34(79.06%) patients and more than 3mm in 9(20.73%) patients. In which only 4 patients had bowel resection in category of more than 3mm wall thickness.

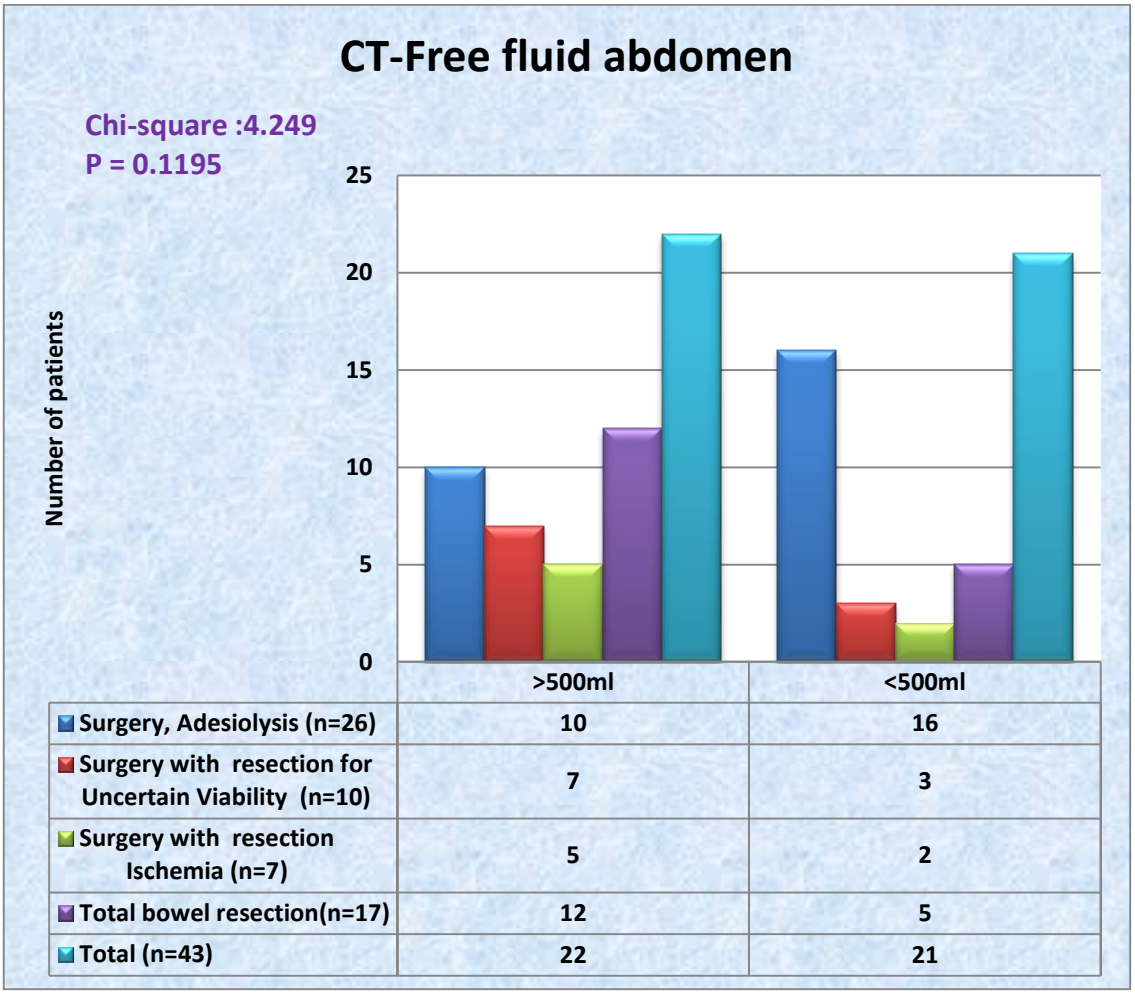
CT-Maximum diameter of intestine in bowel obstruction:



	>4cm	<4cm
Surgery, Adesiolysis (n=26)	6	20
Surgery with resection for Uncertain Viability (n=10)	0	10
Surgery with resection Ischemia (n=7)	4	3
Total bowel resection(n=17)	4	13
Total (n=43)	10	33

In our study maximum wall diameter of intestine in CECT of bowel obstruction are less than 4cms in 33(76.74%) patients and more than 4cms in 10(23.25%) patients. In which only 4 patients had bowel resection in category of more than 4cms wall diameter.

CT-Free fluid abdomen in bowel obstruction:



	>500ml	<500ml
Surgery, Adesiolysis (n=26)	10	16
Surgery with resection for Uncertain Viability (n=10)	7	3
Surgery with resection Ischemia (n=7)	5	2
Total bowel resection(n=17)	12	5
Total (n=43)	22	21

In our study total number of bowel resection were performed in 17 patients in which 12(70.58%) patients had more than 500ml of intra abdominal collection present.

DISCUSSION

This study sought to identifying efficacy of various clinical, laboratory and radiological sings described in literatures for predicting the risk of strangulated small bowel obstruction and comparing available scores in small bowel obstruction.

All variables in the study have formerly been identified as independent predictors of strangulated bowel obstructions from literatures [14-16].

The CT criteria for the diagnosis of small intestinal obstruction have been previously described [17]. These are transition zone, ascites fluid, reduced contrast enhancement, target sign, maximum wall thickness, maximum diameter of intestine, free air, mesentric fluid, mesentric congestion, complete obstruction, partial obstruction and closed loop.

To predict above signs needs both oral and intra venous contrast. Zalcman et al. avoided opacification of the small intestine for several reasons. Obstruction prevents the progression of oral contrast; ingestion of fluid by a patient with bowel obstruction will always lead to vomiting; and, above all, the natural contrast accessible by intestinal fluid allows an optimal study of the bowel wall after contrast material injection. Furthermore, it is illogical and potentially risky to delay CT examination

up to 2 hr [12, 13] while waiting for the opacification of bowel intestinal loops in a patient with abdominal emergency. So we avoided oral contrast in our study. WE were not able to put A.J. Mangran score, because we did not giving oral contrast in our study.

In study of Frager et al.[25] noted the lack of specific findings such as mesenteric fluid, bowel wall enhancement and bowel wall thickening can be seen in malignant obstruction, peritonitis and IBD. In our study bowel wall thickening and wall diameter are not significant in predicting the risk of bowel strangulation and ischemia as Frager et al. study and Schwenter et al.study [1].

Adhesive intestinal obstruction is a relatively repeated problem of laparotomy, as illustrated by several population-based and big case studies. For example, the risk of adhesive intestinal obstruction after appendectomy is about 1% with 30 years of follow-up[19], whereas the risk after partial or subtotal colectomy is as high as 18% [20, 21]. In our study appendectomy associated intestinal obstruction was 16% because in India prevalence of perforated appendix are more. In colectomy we had 9% because incidence of colectomy is less in India. Beck and associates, in a population-based study, establish that the risk of intestinal obstruction was 14.3% subsequent operations in which there was resection and anastomosis of the intestine [22]. In our study small intestinal obstruction followed by previous

resection and anastomosis was 14%. The incidence of adhesive intestinal obstruction after gynecologic surgery is similar to that of appendectomy except for cesarean delivery, in which the risk of subsequent intestinal obstruction is approximately 1 per 2000 procedures [23]. In our study risk of intestinal obstruction in gynecologic surgery is 9%. Lower abdominal or pelvic procedures have a higher risk of postoperative adhesive obstruction than do upper abdominal procedures, such as cholecystectomy and gastrectomy [24].

In our study risk of intestinal obstruction in cholecystectomy is 14% and gastroduodenal surgeries 14%. Furthermore, the risk of intestinal obstruction is greatest in the first several years following the index procedure, although patients may develop intestinal obstruction up to 30 years postoperatively [18].

The percentage of patients who underwent laparotomy with adhesiolysis of adhesions (60.46%) was comparable to other study [1, 5]. Simple adhesiolysis of adhesions is the commonest procedure performed.

In study variable are analysed in Chi-square test, Significance were found in Pain duration more than 3 days (P=0.0029), CRP more than 75mg/l (P=0.0006), CT-Reduced contrast enhancement present (P<0.0001).

Clinicoradiological variables Our Study Vs F. Schwenter et.al. [1].

	Our study	F.Schwenter et.al.	F.Schwenter et.al.	Our Study
	Surgery, No resection Adhesiolysis (n=26)	Surgery, No resection Adhesiolysis (n=93)	Bowel resection (n=45)	Bowel resection (n=17)
Sex				
Male	**17(65.38)**	**38(41)**	**14(31)**	**13(76.47)**
Female	**9(34.61)**	**55(59)**	**31(69)**	**4(23.52)**
Age				
<25	**3(11.53)**	**6(7)**	**2(5)**	**2(11.76)**
>25-50	**9(34.61)**	**20(23)**	**8(18)**	**6(35.29)**
>50	**14(53.84)**	**67(68)**	**35(78)**	**9(52.94)**
Pain duration				
1 day	**10(38.46)**	**37(43)**	**24(57)**	**2(11.76)**
2-3days	**13(50.00)**	**40(47)**	**10(24)**	**7(41.17)**
>3days	**3(11.53)**	**9(10)**	**8(19)**	**8(47.05)**
Fever(F)				
>100	**4(15.38)**	**11(12)**	**4(9)**	**7(41.17)**
<100	**22(84.61)**	**82(88)**	**40(91)**	**10(58.82)**
Guarding				
Present	**16(61.53)**	**51(55)**	**29(67)**	**14(82.35)**
Absent	**10(38.46)**	**42(45)**	**14(33)**	**3(17.64)**
Leucocytosis				
>10000	**17(65.38)**	**57(61)**	**35(80)**	**15(88.23)**
<10000	**9(34.61)**	**36(39)**	**9(20)**	**2(11.76)**
C-reactive protein				
<75mg/l	**19(73.07)**	**74(83)**	**13(31)**	**5(29.41)**
>75mg/l	**7(26.92)**	**15(17)**	**29(69)**	**12(70.58)**
CT-Transition zone				
Present	**25(96.15)**	**87(95)**	**43(96)**	**16(94.11)**
Absent	**1(3.84)**	**5(5)**	**2(4)**	**1(5.88)**
CT-Reduced contrast enhancement				
Present	**3(11.53)**	**17(20)**	**20(56)**	**14(82.35)**
Absent	**23(88.46)**	**70(80)**	**16(44)**	**3(17.64)**
CT-Maximum wall thickness of intestine (mm)				
>3mm	**5(19.23)**	**16(18)**	**16(36)**	**4(23.52)**
<3mm	**21(80.76)**	**75(82)**	**28(64)**	**13(76.47)**
CT-Maximum diameter of intestine(cm)				
>4cm	**6(23.07)**	**16(17)**	**8(18)**	**4(23.52)**
<4cm	**20(76.92)**	**76(83)**	**37(82)**	**13(76.47)**
CT-Free fluid abdomen				
>500ml	**10(38.46)**	**33(36)**	**25(56)**	**12(70.58)**
<500ml	**16(61.53)**	**59(64)**	**20(44)**	**5(29.41)**

* Percentage in bracts

Adhesiolysis category : F.Schwenter et.al. study female(59%) incidence is more than male(41%) . In our study male(65%) incidence is more than female(35%). Other clinicoradiological variables are comparable to our study. In

Bowel resection category : F.Schwenter et.al. study female(69%) incidence is more than male(31%) . In our study male(76%) incidence is more than female(34%). In our clinicoradiological variables are comparable to F.Schwenter et.al. study except fever incidence(41%) is more in our study, pain duration > 3days (47%) also more in our study and free fluid abdomen >500ml (70%) in our study this may be due to late presentations of our cases and multiple observer bias.

Clinicoradiological score by F.Schwenter et al. [1].

Clinicoradiological criteria	Score points
Pain duration >3days	1
Guarding Present	1
Leucocytosis >10000	1
C-reactive protein >75mg/l	1
CT-Reduced contrast enhancement	1
CT-Free fluid abdomen	1

F.Schwenter et al.'s Clinicoradiological score Interpretations

Score 0-1: Moderate evidence against resection.

Score 2: Neutral evidence(neither for nor against resection).

Score 3: Weak evidence for resection.

Score 4-6: Strong evidence for resection.

Clinicoradiological variables are put in to F. Schwenter et.al. [1] score in our study.

F. Schwanter et al. Score in Literature	Surgery, No resection Adhesiolysis (n=26)	Surgery with resection			Total number of Patients in study (n=43)
		Uncertain Viability (n=10)	Ischaemia (n=7)	Total bowel resection(n=17)	
0	6(23.07)*	0(00.00)	0(00.00)	0(00.00)	6(13.95)
1	3(11.53)	1(10.00)	0(00.00)	1(5.88)	4(9.30)
2	6(23.07)	1(10.00)	0(00.00)	1(5.88)	7(16.27)
3	5(19.23)	0(00.00)	1(14.28)	1(5.88)	6(13.95)
4	4(15.38)	3(30.00)	1(14.28)	4(23.52)	8(18.60)
5	2(7.69)	4(40.00)	1(14.20)	5(29.41)	7(16.27)
6	0(00.00)	1(10.00)	4(57.14)	5(29.41)	5(11.62)

* Percentage in bracts

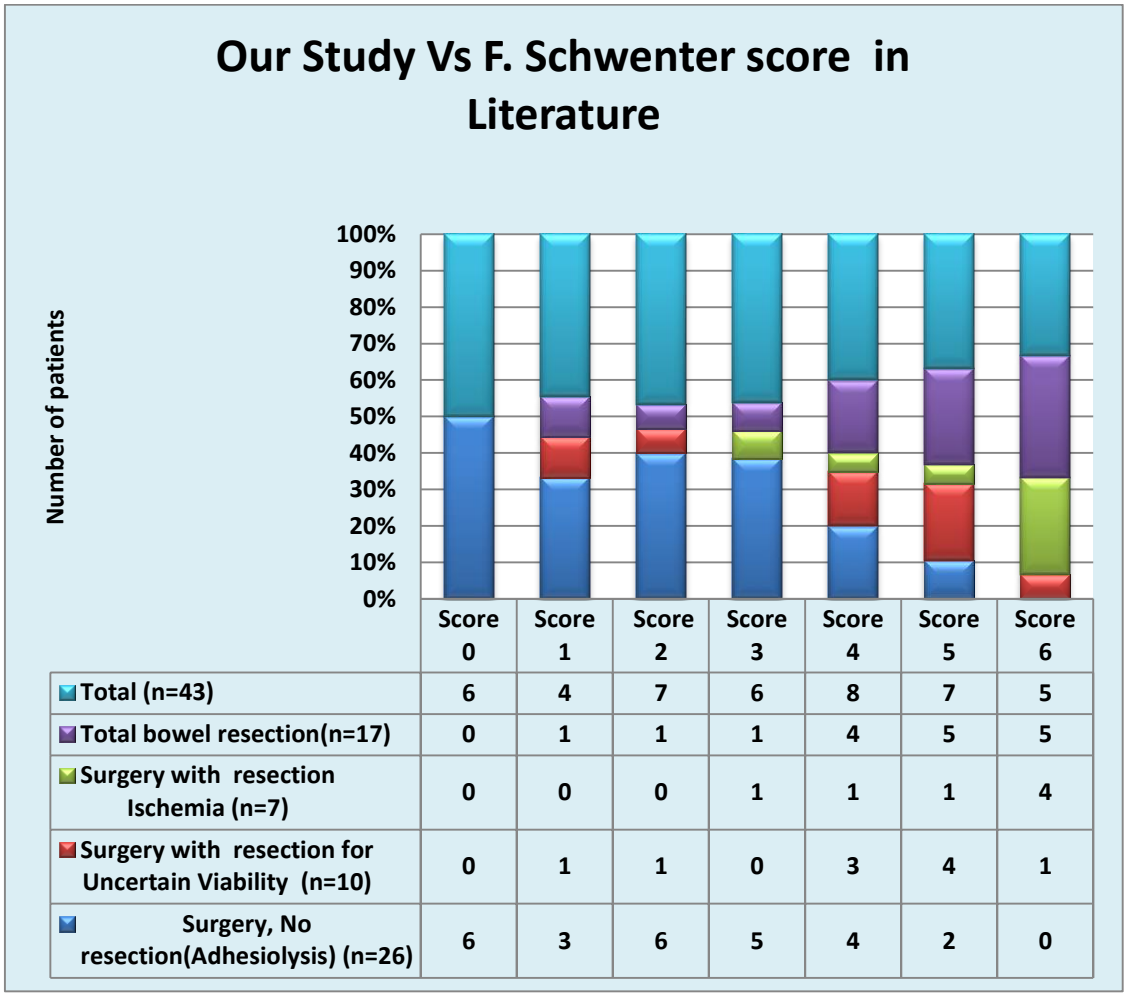
F. Schwenter score in our study, score range 4 to 6 had 6 (89%) patients with ischaemia and 14(83%) patients underwent bowel resection in this group.

In score range 0 to 1 had 9 (34%) patients with adhesiolysis and 1(6%) patient underwent bowel resection in this group.

In score range 2 to 3 had 11 (42%) patients with adhesiolysis and 2(12%) patient underwent bowel resection in this group.

F. Schwenter score is more chance of ischemia in higher scores.

As the purpose was to identify clinicoradiological determinants that distinguish between patients needing urgent lapraotomy with bowel resection and those who can be managed effectively with conservative management.



	Score 0	Score 1	Score 2	Score 3	Score 4	Score 5	Score 6
Total (n=43)	6	4	7	6	8	7	5
Total bowel resection(n=17)	0	1	1	1	4	5	5
Surgery with resection Ischemia (n=7)	0	0	0	1	1	1	4
Surgery with resection for Uncertain Viability (n=10)	0	1	1	0	3	4	1
Surgery, No resection(Adhesiolysis) (n=26)	6	3	6	5	4	2	0

Table shows F. Schwenter score is more chance of ischemia in higher scores.

CT Signs of Intestinal Ischemia in Zalcman et al.[5]. Vs Our Study.

	Our Study	Zalcman et al	Zalcman et al	Our Study
	Surgery, No resection Adhesiolysis (n=26)	Surgery, No resection Adhesiolysis (n=120)	Total bowel resection (n=24)	Total Bowel resection (n=17)
CT-Reduced contrast enhancement				
Present	**3(11.53)**	**4(3)**	**22(92)**	**14(82.35)**
Absent	**23(88.46)**	**116(97)**	**2(8)**	**3(17.64)**
CT-Maximum wall thickness of intestine (mm)				
>3mm	**5(19.23)**	**26(22)**	**4(17)**	**4(23.52)**
<3mm	**21(80.76)**	**94(78)**	**20(83)**	**13(76.47)**
CT-Maximum diameter of intestine(cm)				
>4cm	**6(23.07)**	**No study**	**No study**	**4(23.52)**
<4cm	**20(76.92)**	**No study**	**No study**	**13(76.47)**
CT-Free fluid abdomen				
>500ml	**10(38.46)**	**24(20)**	**17(70)**	**12(70.58)**
<500ml	**16(61.53)**	**96(80)**	**7(30)**	**5(29.41)**
Mesenteric fluid				
Present	**No study**	**12(10)**	**21(88)**	**No study**
Absent	**No study**	**108(90)**	**3(12)**	**No study**
Mesenteric congestion				
Present	**No study**	**25(21)**	**14(58)**	**No study**
Absent	**No study**	**95(79)**	**10(42)**	**No study**

In study of Frager et al.[25] noted the lack of specific findings such as mesenteric fluid, bowel wall enhancement and bowel wall thickening can be seen in malignant obstruction, peritonitis and IBD. So mesenteric fluid and mesenteric congestion are not added in our study. Other CT signs of intestinal ischemia in Zalcman et al.[5] study are comparable to our study.

CONCLUSION

This severity scores if corroborated, dose not reface but may supplement individual clinical judgement this score might help in observing the evolution of a patient's condition after admission, when a conservative approach is favoured initially.

Schwenter score is more chance of ischemia in higher scores.

Single variable is less sensitive in predicting the risk of bowel obstruction and strangulation.

The group of variables needed for predicting the risk of bowel obstruction and strangulation.i.e. Clinicoradiological scores.

In this study sample size was small need more number of cases for precious conclusions.

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PROFOMA

Clinicoradiological scores for predicting the risk of bowel obstruction and strangulation.

Patient details **Patient ID NO :……**

Name :…… **Unit :**

Age: **CT.No :**

Sex : Male/ Female

IP NO :

DOA :

DOS:

DOD:

Address :…….

……...

……..

…… Phone number :……

History

Occupation: **Rural / Urban**

Socioeconomic Status : Upper / Upper middle / Lower middle /Poor

Pain:- **Duration :** **Onset:**

Distention:- **Duration :** **Onset:**

Fever:- **Duration :** **Onset:**

Vomiting:- **Duration :** **Onset:**

Family History :

Past History : DM / HT / Asthma / TB / CAD/Hypothyroid/Hyperthyroid/Other

H/O Surgery year : **Stomach/ Appendicectomy/ colon / Rectam / Liver,biliary,pancreatic / Gynecological / other**

BMI :17-18.5(Underweight)/18.5-24.9(Normal)/ 25-29.9(Overweight)/ Above 30 (obese)

General Examination

Fever(F) :

PR :

BP :

AG :

Examination of Abdomen

Distension : **Present / Absent**

Guarding : **Present / Absent**

BS : **Present / Absent**

PR: Feacal staining - Present / Absent

Roomy reactam - Present / Absent

Invastigations

Hb :

TC :

DC : P L E M

ESR :

Blood Sugar :

Blood Urea :

Serum creatinine :

Na: K: Cl: Hco3:

CRP:

Plain abdominal X-Rays

Supine:

Erect :

CT abdomen contrast

Transition zone : Yes/No

Ascites fluid (ml) : > 500 / <500

Reduced contrast enhancement : Yes/No

Maximum wall thickness (mm) : >3 / <3

Maximum diameter of intestine(cm) : >4 /<4

Free air : Present / Absent

Surgery / Finding:

Date and time of surgery:

Type of adhesions : Band / Matted

Bowel strangulation : None / Uncertain Viability / Ischemia

Type of surgery: Adhesiolysis/ Bowel resection

MASTER CHART

Sl.No	IP.No	Name	Age	Sex	DOA/time	DOS/time	Interval Between A&S(Hours)	Duration Of pain	H/O surgery	Name of surgery	Fever(F)	PR	Guarding (Present / Absent)	TC	CRP	CT-Transition zone (Present / Absent)	CT-Reduced contrast enhancement (Present / Absent)	CT-Maximum wall thickness : >3mm /<3mm	CT-Maximum diameter of intestine : >4cm /<4cm	CT-Free Air (Present / Absent)	CT -Free fluid abdomen : > 500ml/<500ml	Bowel strangulation : None / Uncertain Viable / Non Viable	Bowel resection : None(Adhesiolysis) / Performed	F. Schwanter et al. Score in Literature
1	2532	Kannammal	67	F	04-01-12/09.40AM	04-01-12/07.45PM	6.55	3	Yes	Hysterectomy	99	96	Present	12.5	200	Present	Present	>3mm	<4cm	Absent	< 500ml	Uncertain Viable	Performed	4
2	2551	Deivanai	70	F	07-01-12/11.25AM	07-01-12/07.00PM	7.30	3	Yes	Hemicolectomy	99	95	Absent	11.6	160	Present	Present	<3mm	<4cm	Absent	> 500ml	Uncertain Viable	Performed	4
3	2562	Tirupathy	22	M	09-01-12/01.40PM	10-01-12/03.30AM	14.20	4	Yes	Appendectomy	101	96	Present	11	210	Present	Present	>3mm	<4cm	Present	> 500ml	Non Viable	Performed	6
4	2617	Jayanthi	32	F	11-01-12/05.05PM	11-01-12/08.00PM	2.55	1	Yes	LSCS	98.6	96	Present	12	50	Present	Absent	<3mm	<4cm	Absent	< 500ml	None	Adhesiolysis	2
5	5147	Krishnamoorthy	45	M	11-02-12/12.45PM	11-02-12/03.45PM	3.00	2	Yes	DU Perforation	99.2	100	Present	11.5	180	Present	Absent	<3mm	>4cm	Absent	> 500ml	None	Adhesiolysis	4
6	6157	Balaji	19	M	19-02-12/09.45PM	20-02-12/06.00AM	8.15	1	Yes	Appendectomy	98.8	96	Absent	9	25	Absent	Absent	<3mm	<4cm	Absent	< 500ml	None	Adhesiolysis	0
7	6433	Ramachandran	77	M	21-02-12/10.55PM	22-02-12/02.50AM	4.00	5	No	----------	101	105	Present	12.8	190	Present	Absent	<3mm	<4cm	Absent	> 500ml	Uncertain Viable	Performed	5
8	8126	Gangatharan	72	M	05-03-12/05.15AM	05-03-12/02.50PM	9.35	5	Yes	Ileal perforation	101	98	Present	12	300	Present	Present	<3mm	>4cm	Present	> 500ml	Non Viable	Performed	6
9	9501	sathish	21	M	14-03-12/10.00PM	15-03-12/04.00AM	6.00	1	Yes	Appendectomy	99.2	94	Absent	9.5	55	Present	Absent	<3mm	<4cm	Absent	< 500ml	None	Adhesiolysis	0
10	15925	Saraswathy	65	F	02-04-12/07.30AM	02-04-12/07.00PM	11.30	2	Yes	Cholecystectomy	98.6	98	Present	11.8	40	Present	Absent	<3mm	<4cm	Absent	< 500ml	None	Adhesiolysis	2
11	16941	Rajash	29	M	10-04-12/03.40PM	11-04-12/09.10AM	5.30	3	Yes	Appendectomy	99.6	95	Present	11.9	345	Present	Present	<3mm	<4cm	Absent	> 500ml	Uncertain Viable	Performed	5
12	17189	Maniarul	25	M	12-04-12/11.25AM	12-04-12/06.15PM	6.50	3	No	----------	101	100	Present	12.5	230	Present	Present	>3mm	<4cm	Absent	> 500ml	None	Adhesiolysis	5
13	18012	Balan	55	M	18-04-12/10.30AM	19-04-12/04.45AM	6.15	1	Yes	DU Perforation	100	92	Absent	11	110	Present	Present	<3mm	>4cm	Present	> 500ml	Non Viable	Performed	4
14	19293	Balasundaram	54	M	28-04-12/07.30PM	29-04-12/09.30AM	14.00	1	Yes	TVGJ	99.4	98	Absent	7.5	60	Present	Absent	<3mm	<4cm	Absent	> 500ml	None	Adhesiolysis	1
15	21515	Arumugam	52	M	14-05-12/12.45PM	15-05-12/07.30AM	18.30	3	Yes	Small bowel resection	99	96	Present	11.6	70	Present	Absent	<3mm	<4cm	Absent	> 500ml	None	Adhesiolysis	3
16	21612	Babu	40	M	15-05-12/09.30AM	15-05-12/10.00PM	12.30	5	Yes	Hemicolectomy	102	100	Present	13	190	Present	Present	<3mm	>4cm	Present	> 500ml	Non Viable	Performed	6
17	22713	Menagi	45	F	21-05-12/08.45AM	22-05-12/12.45AM	16.00	3	Yes	Cholecystectomy	98.4	99	Present	12.2	160	Present	Absent	<3mm	<4cm	Absent	< 500ml	None	Adhesiolysis	3
18	23986	Kuttan	65	M	26-05-12/12.00PM	26-05-12/11.15PM	11.15	1	Yes	Hemicolectomy	99.8	92	Present	8	60	Present	Absent	<3mm	<4cm	Absent	< 500ml	Uncertain Viable	Performed	1
19	29940	Moozya	51	M	30-05-12/09.30AM	31-05-12/01.30AM	16.00	1	Yes	Small bowel resection	98.8	93	Absent	8.8	20	Present	Absent	<3mm	<4cm	Absent	< 500ml	None	Adhesiolysis	O
20	31830	Mariyaleela	53	F	05-07-12/11.10PM	06-07-12/07.00AM	7.50	4	No	----------	101.4	102	Present	13.6	190	Present	Absent	<3mm	>4cm	Absent	> 500ml	None	Adhesiolysis	5
21	32385	Jinna	66	M	24-07-12/08.30AM	24-07-12/09.00PM	13.00	1	Yes	Whipple	99.2	98	Absent	12.4	230	Present	Absent	<3mm	<4cm	Absent	> 500ml	None	Adhesiolysis	3
22	38537	Murugan	30	M	02-08-12/07.45PM	03-08-12/01.00AM	4.15	3	Yes	Appendectomy	98.6	96	Present	14.6	210	Present	Present	<3mm	<4cm	Absent	> 500ml	Uncertain Viable	Performed	5
23	33854	Varadharajan	40	M	05-08-12/09.10AM	06-08-12/01.30AM	16.20	3	Yes	DU Perforation	98.8	94	Present	11.8	35	Present	Present	>3mm	>4cm	Absent	< 500ml	None	Adhesiolysis	3
24	34601	Shanmugam	55	M	10-08-12/09.35PM	11-08-12/11.00AM	13.25	1	Yes	Small bowel resection for GIST	99.4	93	Present	12.2	50	Present	Absent	<3mm	<4cm	Absent	< 500ml	None	Adhesiolysis	2
25	34657	Kasthuri	50	F	11-08-12/12.10PM	12-08-12/01.30AM	13.20	4	Yes	Hysterectomy	101	98	Present	13	150	Present	Present	>3mm	<4cm	Absent	< 500ml	Non Viable	Performed	5
26	35969	Chithirai	60	M	21-08-12/09.20PM	22-08-12/10.00AM	12.40	2	Yes	Nephrectomy	98.2	92	Absent	8.9	65	Present	Absent	<3mm	<4cm	Absent	< 500ml	None	Adhesiolysis	0
27	36690	Babu	23	M	27-08-12/10.20AM	28-08-12/04.15AM	17.55	3	Yes	Appendectomy	99	98	Present	13.9	230	Present	Present	<3mm	<4cm	Absent	> 500ml	Uncertain Viable	Performed	5
28	37298	Motchammal	54	F	31-08-12/07.30AM	31-08-12/08.00PM	12.30	1	Yes	Cholecystectomy	98	90	Absent	7.3	70	Present	Absent	<3mm	<4cm	Absent	< 500ml	None	Adhesiolysis	0
29	38436	Susana	52	F	09-09-12/07.30AM	09-09-12/12.45PM	5.15	6	No	----------	101	96	Present	12.5	120	Absent	Present	<3mm	>4cm	Present	> 500ml	Non Viable	Performed	6
30	40289	Vijayan	63	M	22-09-12/05.10PM	23-09-12/06.30AM	13.20	3	Yes	CBD	99.2	98	Present	11.9	45	Present	Absent	>3mm	>4cm	Absent	> 500ml	None	Adhesiolysis	2
31	41986	Ponusamy	60	M	04-10-12/12.30PM	04-10-12/11.30PM	11.00	3	Yes	Splenectomy	98.6	92	Absent	8.2	30	Present	Absent	<3mm	<4cm	Absent	< 500ml	None	Adhesiolysis	1
32	43176	Chinnaponnu	60	F	15-10-12/09.30PM	15-10-12/10.50PM	12.20	4	No	----------	100.8	102	Present	10.9	165	Present	Absent	<3mm	>4cm	Absent	> 500ml	None	Adhesiolysis	4
33	43339	Duraisamy	62	M	15-10-12/09.40PM	16-10-12/03.30AM	5.40	2	Yes	Cholecystectomy	98.4	88	Absent	8.3	60	Present	Absent	<3mm	<4cm	Absent	< 500ml	None	Adhesiolysis	1
34	43480	Ponusamy	61	M	16-10-12/02.05PM	16-10-12/11.30PM	9.25	1	Yes	Ileal perforation	98.8	98	Present	9	55	Present	Present	<3mm	<4cm	Absent	< 500ml	Uncertain Viable	Performed	2
35	44258	Sugumar	63	M	22-10-12/01.10PM	22-10-12/09.30PM	8.20	3	Yes	Gastrectomy	98.8	99	Present	10.7	45	Present	Absent	<3mm	<4cm	Absent	< 500ml	None	Adhesiolysis	2
36	44343	Kasi	25	M	23-10-12/08.30AM	23-10-12/11.30PM	15.00	2	Yes	Appendectomy	99.6	110	Present	12.3	30	Present	Present	>3mm	<4cm	Absent	< 500ml	None	Adhesiolysis	3
37	44802	Desamma	50	F	27-10-12/05.20PM	28-10-12/04.30AM	11.10	1	Yes	Hysterectomy	98.2	100	Present	11.7	20	Present	Absent	<3mm	<4cm	Absent	< 500ml	None	Adhesiolysis	2
38	49398	Panibai	48	F	31-10-12/10.40AM	31-10-12/11.30PM	11.50	1	Yes	Cholecystectomy	98.4	79	Absent	9.2	46	Present	Absent	>3mm	<4cm	Absent	< 500ml	None	Adhesiolysis	0
39	51388	Balaraman	55	M	14-11-12/08.30AM	14-11-12/02.30PM	6.00	5	No	----------	101	110	Present	12.6	190	Present	Present	<3mm	<4cm	Absent	> 500ml	Uncertain Viable	Performed	6
40	51984	Shankaralingam	34	M	17-11-12/12.30PM	18-11-12/10.30AM	22.00	4	No	----------	99.8	108	Present	12.3	39	Present	Absent	<3mm	>4cm	Absent	> 500ml	None	Adhesiolysis	4
41	52133	Babu	40	M	19-11-12/04.55PM	19-11-12/11.30PM	6.35	4	Yes	Sigmoidectomy	100	93	Absent	11	60	Present	Present	>3mm	<4cm	Absent	< 500ml	Non Viable	Performed	3
42	52280	Venugopal	42	M	20-11-12/12.30PM	20-11-12/11.00PM	10.30	3	Yes	Pancreas	99.6	92	Present	13.2	165	Present	Absent	<3mm	<4cm	Absent	> 500ml	Uncertain Viable	Performed	4
43	52976	Nirmala	20	F	24-11-12/08.00AM	24-11-12/09.30PM	12.30	3	No	Abdominal cocoon	101.2	115	Present	13.6	210	Present	Absent	<3mm	<4cm	Absent	> 500ml	None	Adhesiolysis	4

INSTITUTIONAL ETHICAL COMMITTEE,
STANLEY MEDICAL COLLEGE, CHENNAI-1

Title of the Work : Clinicoradiological scores for predicting the risk of Bowel obstruction and strangulation

Principal Investigator : Dr.A.R.Baskar

Designation : PG in M.S (GS)

Department : Department of General Surgery
Government Stanley Medical College,
Chennai-1

The request for an approval from the Institutional Ethical Committee (IEC) was considered on the IEC meeting held on 06.03.2012 at the Council Hall, Stanley Medical College, Chennai-1 at 2PM

The members of the Committee, the secretary and the Chairman are pleased to approve the proposed work mentioned above, submitted by the principal investigator.

The Principal investigator and their team are directed to adhere to the guidelines given below:

1. You should inform the IEC in case of changes in study procedure, site investigator investigation or guide or any other changes.
2. You should not deviate from the area of the work for which you applied for ethical clearance.
3. You should inform the IEC immediately, in case of any adverse events or serious adverse reaction.
4. You should abide to the rules and regulation of the institution(s).
5. You should complete the work within the specified period and if any extension of time is required, you should apply for permission again and do the work.
6. You should submit the summary of the work to the ethical committee on completion of the work.

12/10/12

MEMBER SECRETARY,
IEC, SMC, CHENNAI

ஒப்புதல் படிவம்

ஆய்வு செய்யப்படும் தலைப்பு

மருத்துவ பரிசோதனை மூலம் குடல் அடைப்பு மற்றும் அழுகளை கண்டறிதல்

ஆராய்ச்சி நிலையம்

பொது அறுவை சிகிச்சைப்பிரிவு,
ஸ்டான்லி மருத்துவக்கல்லூரி, சென்னை - 600 001.

பங்கு பெறுபவரின் எண் .....

பங்கு பெறுபவரின் பெயர்/வயது/விலாசம் :.....

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எனது .....குடல்க்கு அடைப்பு உள்ளது எனவும் இதற்கு இரத்தப் பரிசோதனை, உடல் பரிசோதனை, வயிறு X-Ray மற்றும் மருந்து செலுத்தி CT வயிறு உடற்கூறு ஆய்வு மூலம் குடல் அழுகளை கண்டறியவும், இந்த குடல் அடைப்புக்கு மருத்துவ முறையிலும் அல்லது தேவைப்பட்டால் அறுவை சிகிச்சை செய்யப்படும் எனவும், அறுவை சிகிச்சையில் வயிற்று பகுதியை திறந்து குடல் அடைப்பை சரி செய்யவும், குடல் பகுதி அழுகிய நிலையில் இருந்தால், அழுகிய பகுதியை நீக்கிவிட்டு இணைத்துக் கொள்ளவும், இணைக்க முடியாத நிலையில் குடலை எடுத்து வயிற்றுப் பகுதியில் வைத்து மலம் வெளியில் செல்ல நேரிடும் எனவும் மருத்துவர் மூலம் அறிவேன். இந்த மேற்கூறிய இரத்தப்பரிசோதனைகளுக்கும், மருந்து செலுத்தி CT வயிறு உடற்கூறு ஆய்வுக்கும் என் முழுமனதுடன் சம்மதிக்கிறேன்.

திசுப்பரிசோதனையின் முடிவுகளையும் என்னுடையமற்ற பரிசோதனைகளின் முடிவுகளையும் மருத்துவரும், மருத்துவமனையும் ஆய்வுக்காக பயன்படுத்தப்படும்.

இந்த நோய் தொடர்பான விளக்கங்கள் மற்றும் பின் விளைவுகளை மருத்துவர் எனக்கு தெரிந்த மொழியில் தெளிவாக விளக்கினார்.

பங்கேற்பவரின் கையொப்பம் ..... இடம் ..... தேதி .....

பெற்றோர் / கணவர் / மனைவி கையொப்பம் .....

ஆய்வாளரின் கையொப்பம் .....

இடம் ..... தேதி .....

தகவல் படிவம்

ஆய்வு செய்யப்படும் தலைப்பு

மருத்துவ பரிசோதனை மூலம் குடல் அடைப்பு மற்றும் அழுகளை கண்டறிதல்

ஆராய்ச்சி நிலையம்

பொது அறுவை சிகிச்சைப்பிரிவு,
ஸ்டான்லி மருத்துவக்கல்லூரி, சென்னை - 600 001.

பங்கு பெறுபவரின் எண் .....

பங்கு பெறுபவரின் பெயர்/வயது/விலாசம் :.....

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உங்களுக்கு வயிற்றில் குடல் அடைப்பு ஏற்பட்டு உள்ளது. இதற்கு இரத்தப்பரிசோதனை மற்றும் மருத்து செலுத்தி CT வயிறு உடற்கூறு பரிசோதனை செய்யப்படும். இந்த பரிசோதனை முடிவில் உங்களுக்கு குடல் அடைப்பு ஆரம்ப நிலையில் இருந்தால் மருத்துவ முறையில் சரி செய்ய முயற்சிக்கப்படும், குடல் அடைப்பு முற்றிய நிலையில் இருந்தால் அறுவை சிகிச்சை செய்யப்படும். அறுவை சிகிச்சையில் குடல் பகுதி அழுகிய நிலையில் இருந்தால், அழுகிய பகுதியை எடுத்துவிட்டு நல்ல நிலையில் உள்ள குடல் பகுதிகளை இணைக்கப்படும். குடல் பகுதியை இணைக்க முடியாவிட்டால் குடல் பகுதியை தற்காலிகமாக வயிற்றுக்கு வெளியில் வைக்கப்படும். இந்த குடல் பகுதி இரண்டு முதல் மூன்று மாதங்களில் உடல் நிலையை பொறுத்து அறுவை சிகிச்சை செய்து மீண்டும் வயிற்றினுள் வைக்கப்படும்.

திசுப்பரிசோதனையின் முடிவுகளையும் என்னுடைய மற்ற பரிசோதனைகளின் முடிவுகளையும் மருத்துவரும், மருத்துவமனையும் ஆய்வுக்காக பயன்படுத்தப்படும்.

பங்கேற்பவரின் கையொப்பம் .....

இடம் ..... தேதி .....

பெற்றோர் / கணவர் / மனைவி கையொப்பம் .....

ஆய்வாளரின் கையொப்பம் .....

இடம் ..... தேதி .....

ுய ஒப்புதல் படிவம்

ஆராய்ச்சி நிலையம் : அரசு ஸ்டான்லி மருத்துவமனை,
சென்னை - 600 001.

பங்கு பெறுபவரின் பெயர் :

பங்கு பெறுபவரின் எண் :

பங்கு பெறுவர் இதனை (✓) குறிக்கவும்.

மேலே குறிப்பிட்டுள்ள மருத்துவ ஆய்வின் விவரங்கள் எனக்கு விளக்கப்பட்டது. என்னுடைய சந்தேகங்களை கேட்கவும், அதற்கான தகுந்த விளக்கங்களை பெறவும் வாய்ப்பளிக்கப்பட்டது. ☐

நான் இவ்வாய்வில் தன்னிச்சையாகதான் பங்கேற்கிறேன். எந்த காரணத்தினாலோ எந்த கட்டத்திலும் எந்த சட்ட சிக்கலுக்கும் உட்படாமல் நான் இவ்வாய்வில் இருந்து விலகி கொள்ளலாம் என்றும் அறிந்து கொண்டேன். ☐

இந்த ஆய்வு சம்பந்தமாகவோ, இதை சார்ந்த மேலும் ஆய்வு மேற்கொள்ளும போதும் இந்த ஆய்வில் பங்குபெறும் மருத்துவர் என்னுடைய மருத்துவ அறிக்கைகளை பார்ப்பதற்கு என் அனுமதி தேவையில்லை என அறிந்து கொள்கிறேன். நான் ஆய்வில் இருந்து விலகிக் கொண்டாலும் இது பொருந்தும் என அறிகிறேன். ☐

இந்த ஆய்வின் மூலம் கிடைக்கும் தகவல்களையும், பரிசோதனை முடிவுகளையும் மற்றும் சிகிச்சை தொடர்பான தகவல்களையும் மருத்துவர் மேற்கொள்ளும் ஆய்வில் பயன்படுத்திக் கொள்ளவும் அதை பிரசுரிக்கவும் என் முழு மனதுடன் சம்மதிக்கிறேன். ☐

இந்த ஆய்வில் பங்கு கொள்ள ஒப்புக் கொள்கிறேன். எனக்கு கொடுக்கப்பட்ட அறிவுரைகளின்படி நடந்து கொள்வதுடன் இந்த ஆய்வை மேற்கொள்ளும் மருத்துவ அணிக்கு உண்மையுடன் இருப்பேன் என்றும் உறுதியளிக்கிறேன். என் உடல் நலம் பாதிக்கப்பட்டாலோ அல்லது எதிர்பாராத வழக்கத்திற்கு மாறான நோய்க்குறி தென்பட்டாலோ உடனே அதை மருத்துவ அணிக்கு தெரிவிப்பேன் என உறுதி அளிக்கிறேன். ☐

இந்த ஆய்வில் எனக்கு இரத்தம், சிறுநீர், எக்ஸரே, ஸ்கேன் உட்பட அனைத்து பரிசோதனைகளையும் செய்து கொள்ள நான் முழு மனதுடன் சம்மதிக்கிறேன். ☐

பங்கேற்பவரின் கையொப்பம் ..... இடம் ..... தேதி

கட்டைவிரல் ரேகை

பங்கேற்பவரின் பெயர் மற்றும் விலாசம் .....

ஆய்வாளரின் கையொப்பம் ..... இடம் ..... தேதி

ஆய்வாளரின் பெயர் .....

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